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Checklist

Checklist of land snail species of Gua Rumbang, Sarawak, Malaysian Borneo (Mollusca, Gastropoda), with a description of a new species, *Diplommatina rumbangensis* sp. nov.

Nurul Syafiqah Nasir[1,2], Jie Ying Lee[1,2], Mohammad Effendi Marzuki[2], Jaap J. Vermeulen[3], Jayasilan Mohd-Azlan[2], Mohd Zacaery Khalik[1,2]

1 *Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia*
2 *Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak, Malaysia*
3 *JK Art and Science, Lauwerbes 8, 2318 AT, Leiden, Netherlands*

Corresponding authors: Nurul Syafiqah Nasir (mnsyafiqahnasir@gmail.com); Mohd Zacaery Khalik (kmzacaery@unimas.my)

Abstract

The current study presents an annotated checklist of the land snail species in the vicinity of the limestone hill of Gua (= cave) Rumbang, an outcrop located at the district of Padawan, Sarawak, Malaysian Borneo. The sampling was conducted at the surrounding areas and near the cave's entrance. A total of 62 species, involving 19 families and 38 genera, were recorded. Comparison with previous surveys made in the Bau limestone hills revealed similarities with respect to the species-rich families Diplommatinidae and Cyclophoridae, and the genera *Kaliella* and *Diplommatina*, highlighting the regional consistency of the land snail diversity of the Bau-Padawan-Serian cluster. Possibly because of its smaller size, Gua Rumbang is home to two endemic species, while there are eight endemic species in the Bau limestone karsts. This suggests a potential for a significant species diversity within the areas of the limestone ranges that remain to be explored. Nonetheless, the occurrence of endemic species in Gua Rumbang highlights the need to conserve certain areas within the Padawan limestone range since hitherto no protected areas have been proposed in this region. In this checklist, a new species for science is also described, namely, *Diplommatina rumbangensis* **sp. nov.**

Key words: Endemism, habitat types, limestone outcrop, species abundance, species diversity

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Introduction

Borneo's karst areas are renowned for their diverse and abundant biodiversity, including species that are endemic to specific sites or regions (Vermeulen and Whitten 1999). The species abundance is mainly caused by the multitude of different ecological niches which typically occur in karst areas, ranging from sun-drenched, bare rock faces to damp, and dark caves (Clements et al. 2006). These ecosystems are characterised by high calcium carbonate deposits and serve as habitat for numerous calcium-dependent organisms, including land snails.

Gua (= Cave) Rumbang (1°16.77'N, 110°15.69'E) is located to the north of Gunung Temugan, a limestone outcrop in the Padawan district. Gua Rumbang

is part of a long belt of limestone ranges in the south of Kuching division called the 'Bau-Padawan-Serian' cluster (see Fig. 1) between the town of Bau in the west, and the Serian district in the east (Liew et al. 2021). This cave has been explored and documented for the first time by Spencer St. John in the 1800s (John 1862). Five species of land snails were described from Gua Rumbang in 1894–1895, namely *Georissa everetti* E. A. Smith, 1895, *Kaliella rumbangensis* (E. A. Smith, 1895), *Ditropopsis everetti* (E. A. Smith, 1895), *Plectostoma pumilio* (E. A. Smith, 1894a), and *Plectostoma austeni* (E. A. Smith, 1894a). Since then, this limestone hill was not further inventoried. Therefore, this study presents the first checklist of the malacofauna of Gua Rumbang after almost 130 years.

Recently, Marzuki et al. (2021) documented the land snail fauna in the south of Bau district, in the western part of the Kuching limestone ranges. The study listed 122 land snail species including 46 species that are endemic to these ranges. According to Vermeulen (1993, 1994) limestone ranges are areas of endemism, with species occurring restricted to the ranges or parts of them. Despite collecting efforts have focused on the more accessible hills of the ranges, it is probable that some species are endemic to only limited parts of the ranges (Foon et al. 2017; Phung et al. 2018; Foon and Marzuki 2023; Lee et al. 2024). Hence, land snails are a suitable indicator group for limestone biodiversity studies (Vermeulen 2003; Vermeulen and Junau 2007; Liew et al. 2014; Marzuki et al. 2021; Vermeulen and Liew 2022).

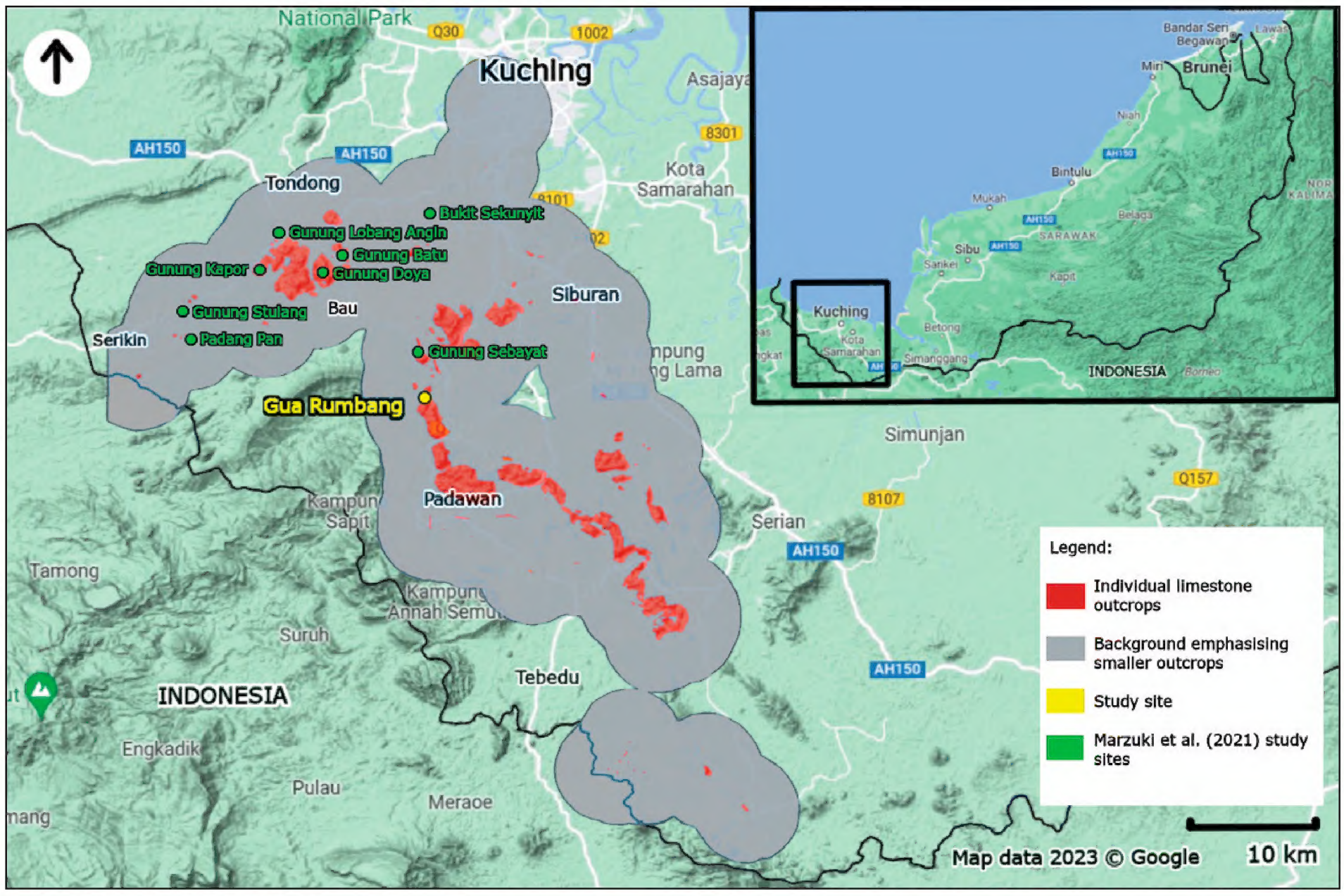

Figure 1. Map showing the location of Gua Rumbang (yellow) on top of an overlay of limestone outcrops in the districts of Kuching, Bau, Siburan, Padawan, Serian, and Tebedu extracted from Liew et al. (2021). The green locations are the hills surveyed by Marzuki et al. (2021). The map highlights individual limestone outcrops with red, whereas grey areas around the limestone outcrops are background to emphasise outcrops that are too small to discern on the map.

In this study, we incorporate the endemic species of these limestone ranges based on literature data, information from the collections at the Zoological Museum of Universiti Malaysia Sarawak (UNIMAS), and the combined knowledge of the authors. Next, we present an annotated checklist of land snail species that were found during our survey. Finally, we describe a new species of land snail of the family Diplommatinidae, namely, *Diplommatina rumbangensis* sp. nov.

Materials and methods

Land snail sampling and processing

Two separate field surveys were conducted at the surrounding areas near the Gua Rumbang's entrance (1°16.77'N, 110°15.69'E) on 2 September 2022 and 28 June 2023. Two 20 × 20 m plots were established, and the same plots were sampled for both field surveys. Four persons spent an hour for each plot, totalling 16 person-hours. All living snails and empty shells were collected during the search. This includes sifting through leaf litter, scanning the surface of limestone rocks, wood logs, and the surrounding karst vegetation. The microhabitats where the land snails were found were characterized with respect to their leaf litter, limestone, and vegetation (see Table 1). Leaf litter is the surface litter of the outermost layer of the ground. Limestone rocks refers to the vertical and horizontal wall surfaces, pockets, and cervices. Vegetation refers to the leaf surface, tree trunks and vines. Approximately five litres of soil collected from the area were dried before micro snails and shells were extracted by floatation and left to dry. Living specimens were stored in sample vials containing 70% ethanol. Empty shells were cleaned and dried prior to storage in the museum collection. Specimens were identified by their shell morphology using the literature of Bornean land snails (Vermeulen 1991, 1993, 1994, 1996; Khalik et al. 2019; Marzuki et al. 2021; Vermeulen and Liew 2022). The material was deposited at the Zoological Museum UNIMAS (**ZMU**), with duplicate specimens deposited in the private collection of the third author (**ME**).

Imaging and scanning electron microscopy

A representative shell of each species was selected for imaging. A set of stacked images were taken using a Nikon DSLR with CaptureOne 15.0.0 software. Then, the composite images were generated in Helicon 8.2.0 software. The images were edited using Adobe Photoshop 24.1 and GIMP 2.10.34 software. Scanning electron microscopy was used to obtain detailed images of *Diplommatina rumbangensis* sp. nov. To this end shells of the new species were coated with platinum.

Land snails diversity and endemism

The species diversity observed at Gua Rumbang was compared with land snail diversity data from elsewhere in Sarawak, including Bau (Marzuki et al. 2021), and limestone hills outside of western Sarawak namely Bukit (= Hill) Sarang (Vermeulen and Junau 2007), Niah National Park (NP), and Gunung

Table 1. List of living snails collected in Gua Rumbang and their habitat types.

Family / Species	Number of individuals	Relative abundance (%)	Habitat types		
			Leaf litter	Vegetation	Limestone
Alycaeidae					
Pincerna globosa	59	2	–	59	–
Stomacosmethis hosei	492	16.7	3	–	489
Ariophantidae					
Rahula raricostulata	21	0.7	21	–	–
Macrochlamys sanctijohni	1	0.03	1	–	–
Macrochlamys infans	2	0.07	1	1	–
Vitrinula glutinosa	2	0.07	–	2	–
Camaenidae					
Amphidromus angulatus	1	0.03	–	1	–
Amphidromus epidemiae	2	0.07	–	2	–
Chronidae					
Kaliella busauensis	28	0.95	–	28	–
Kaliella barrakporensis	73	2.5	–	73	–
Kaliella calculosa	4	0.1	–	4	–
Kaliella microconus	67	2.3	–	67	–
Kaliella rumbangensis	585	19.9	–	552	33
Kaliella scandens	3	0.1	–	3	–
Exrhysota brookei	1	0.03	–	–	1
Cyclophoridae					
Cyclophorus perdix borneensis	2	0.07	2	–	–
Craspedotropis borneensis	176	6	173	–	3
Japonia barbata	1	0.03	1	–	–
Japonia borneensis	3	0.1	3	–	–
Japonia mundyana	1	0.03	–	1	–
Opisthoporus biciliatus	2	0.07	1	–	1
Diapheridae					
Platycochlium sarawakense	270	9.2	270	–	–
Diplommatinidae					
Diplommatina baritensis	111	3.8	111	–	–
Diplommatina concinna	2	0.07	2	–	–
Diplommatina maduana maduana	6	0.2	6	–	–
Diplommatina adversa	5	0.2	5	–	–
Plectostoma austeni	34	1.2	–	–	34
Plectostoma anisopterum	120	4.1	–	–	120
Plectostoma pumilio	670	22.6	–	–	670
Opisthostoma brachyacrum lambii	44	1.5	44	–	–
Opisthostoma tridens	6	0.2	–	–	6
Dyakiidae					
Dyakia subdebilis	4	0.1	–	3	1
Rhinocochlis nasuta	2	0.07	–	2	–
Helicarionidae					
Helicarion dyakanum	2	0.07	–	2	–
Hydrocenidae					
Georissa everetti	17	0.6	–	–	17
Punctidae					
Paralaoma sarawakensis	96	3.3	96	–	–
Valloniidae					
Pupisoma dioscoricola	33	1.1	–	33	–
Total	2,948		740	833	1,375

(= Mountain) Mulu National Park (NP) (Vermeulen 2003). These localities are isolated and far from the limestone ranges of western Sarawak, since Niah NP and Gunung Mulu NP are in the east, while Bukit Sarang is located in central Sarawak. We evaluated species diversity by considering two factors: (1) species richness, i.e. the total number of species per locality, and (2) the number of unique species, i.e. the number of species that occur only in one of the surveyed limestone hills. These species are for the time being considered unique, even if some of them may turn up in other limestone hills that are yet-to-be surveyed (Foon et al. 2017). Representative land snails sampled during the surveys are shown in Figs 4–24. The following abbreviations are used in the text:

SH	Shell height
SW	Shell width
ME	Marzuki Effendi
NP	National Park
UNIMAS	Universiti Malaysia Sarawak
ZMU	Zoological Museum UNIMAS

Results and discussion

Land snail diversity and endemism

A total of 5,221 individuals were obtained from surveys done at Gua Rumbang comprising 62 species of land snails belonging to 38 genera and 19 families (see Suppl. material 1). The family of Diplommatinidae was the most species-rich family, with 11 species. This was followed by Cyclophoridae with ten species. The most diverse genera were *Diplommatina* and *Kaliella* with six species each.

Our study targeted the land snails of Gua Rumbang in Padawan, which is a hill in the central part of the Bau-Padawan-Serian limestone range of western Sarawak. The malacofauna of the Padawan limestone ranges remains largely to be explored. When comparing with the malacofauna survey conducted by Marzuki et al. (2021) in Bau, the species compositions are similar in terms of the most diverse families (i.e., Diplommatinidae and Cyclophoridae) and genera (i.e., *Kaliella* and *Diplommatina*). Marzuki et al. (2021) recorded eight endemic land snail species, whereas this study found two endemic species in Gua Rumbang (Table 2). This probably reflects the smaller sampling area at Gua Rumbang compared to the more extensive sampling area covering eight limestone hills in the Bau limestone range. Among these eight limestone hills, Gunung Kapor had the highest number of species (n = 11) that did not overlap with the other limestone hills. Of these 11 species, only two species are endemic to Gunung Kapor.

When compared with other limestone karsts in Sarawak beyond the Bau-Padawan-Serian cluster, Gua Rumbang possesses the lowest species richness and number of endemic species (Table 2). Both Niah NP and Gunung Mulu NP have a higher species richness and more endemic species than Gua Rumbang. Also, this may be explained by the larger areas of both these national parks compared to Gua Rumbang. In contrast, Bukit Sarang is

Table 2. List of limestone hills with the number of species richness and endemic species in Sarawak.

Limestone hill	Area (km²)	Species richness	Endemic species	Reference
Niah National Park	9	108	38	Vermeulen 2003
Gunung Mulu National Park	80	97	33	Vermeulen 2003
Bukit Sarang	0.3	83	26	Vermeulen and Junau 2007
Bau limestone ranges				
Gunung Kapor	0.08	91	2	Marzuki et al. 2021
Gunung Batu	0.06	83	3	
Gunung Doya	0.09	78	1	
Gunung Lobang Angin	0.07	50	2	
Padang Pan	0.02	25	0	
Bukit Sekunyit	0.07	17	0	
Gunung Sebayat	0.03	14	0	
Gunung Stulang	0.06	12	0	
Gua Rumbang	0.04	62	2	Current study

home to a large number of endemic species despite its relatively small area (0.3 km^2). The high endemism of land snails in Bukit Sarang may be due to its geographic isolation from nearby limestone ranges, such as Ulu Kakus, which is 60 km away.

Based on these comparisons, two species are endemic to Gua Rumbang, but when considered together with the Bau-Padawan-Serian cluster, the number increases to 50 endemic species. No fewer than 80 species from the Bau-Padawan-Serian cluster can be found beyond the southwestern Sarawak limestone clusters. There are also 37 species from Gua Rumbang that have a wider distribution beyond the borders of Sarawak. However, these comparisons should be interpreted with some reservation since each study used different sampling methods, so that their degrees of coverage and completeness may differ. Consequently, the assessments and explanations regarding species richness and endemism are only preliminary and could change if a standardized sampling regime is applied (sensu Clements et al. 2008; Liew et al. 2008; Foon et al. 2017).

The presence of species that are endemic to only a small part of the range complicates effective biodiversity conservation of the Bau-Padawan-Serian limestone ranges. Based on Marzuki et al. (2021), four out of eight surveyed limestone hills in Bau had endemic species (Table 2). This could indicate a high species diversity for the unexplored parts of the Bau-Padawan-Serian limestone range. Hence, it may be necessary to conserve several parts of the ranges to safeguard a representative selection of the limestone biodiversity. Gua Rumbang is a part of Gunung Temugan, with an approximate size of 6.3656 km^2 (Liew et al. 2021) and no protected areas have been proposed in this vicinity. The selection of the areas should be based on studies of the fauna composition of the whole of the Bau-Padawan-Serian limestone ranges. In this context, land snails are a suitable indicator group for such studies, as their abundance and species composition can reflect the impact of habitat fragmentation and disturbance (Nekola 2012; Douglas et al. 2013; Dhiman et al. 2020; Lee et al. 2024).

Systematics

Class Gastropoda Cuvier, 1795,
Subclass Caenogastropoda Cox, 1960
Family Diplommatinidae L. Pfeiffer, 1856
Genus *Diplommatina* Benson, 1849

***Diplommatina rumbangensis* sp. nov.**
https://zoobank.org/C34336B3-6421-49FD-84AC-154E8A1C4691
Figs 2A–F, 8E

Type material examined. *Holotype*. Malaysia • (SH = 5.25 mm, SW = 2.52 mm); Sarawak, Gua Rumbang, near Kampung Semadang, along Sarawak Kanan River, ~ 11 miles Southwest Padawan, Kuching Division; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir and M. E. Marzuki leg.; MZU.MOL.22.132. ***Paratypes*.** Malaysia • 4 ex. (SH = 5.1 mm, SW = 2.7 mm; SH = 5.06 mm, SW = 2.5 mm; SH = 5.37 mm, SW = 2.58 mm; SH = 5.01 mm, SW = 2.65 mm); same data as holotype; MZU.MOL.22.491, ME 14983, ME 15021. Both holotype and paratypes were deposited in Zoological Museum UNIMAS (ZMU) and additional paratypes in the private collection of the third author.

Description. Shell dextral, fusiform to moderately conical, reddish orange, shining and translucent, with the penultimate whorl widest, convex, well rounded. Suture impressed. Protoconch with 1½ whorls, punctate with small pits, without radial and spiral lines. Constriction nearly level with the edge between the parietal and columellar side of the peristome, with two parietales, two upper longitudinal palatales which are not covered by the peristome on the outer surface of the shell, one transversal palatalis and one columellaris. The columellaris positioned at the start of the constriction together with the longitudinal palatales. Tuba approximately ¾ whorl. ***Sculpture*:** Radial ribs on the top whorls only, widely spaced, inconspicuous, but halfway the whorl with an almost tubular projection, in adults sometimes abraded to a semi-circular scar. Spiral striation inconspicuous, on top whorls only. ***Aperture*:** Hardly tilted regarding the coiling axis; columellaris distinct, directed downwards. Peristome double, expanding; palatal side hardly sinuous, without edge; basal side with an edge; basal edge hardly sinuous, rounded; inner peristome somewhat expanding beyond the outer, with a palatal lip, free and erect on the columellar side, expanding on the parietal side. ***Umbilicus*:** Open, narrow. ***Dimensions*:** Height 5.01–5.37 mm; width 2.5–2.7 mm; number of whorls 6¾–7; height and width aperture 1.91–2.05 mm; 2.05–2.09 mm.

Differential diagnosis. *Diplommatina rumbangensis* sp. nov. has two distinct upper longitudinal palatales at the shell constriction that are not covered by the peristome on the outer surface of the shell (Fig. 3). This differs from *Diplommatina spinosa* Godwin-Austen, 1889 which has one longitudinal palatalis only. Additionally, *D. spinosa* exhibits a tubular projection that extends to the penultimate whorl, whereas in *D. rumbangensis* sp. nov., this projection only reaches halfway through the ultimate whorl. *Diplommatina spinosa* is distributed in the Kuching and Serian divisions. It also differs from *Diplommatina bicoronata bicoronata* von Martens, 1884 which is endemic to Kalimantan, Indonesia by having two or three longitudinal palatales with two of them

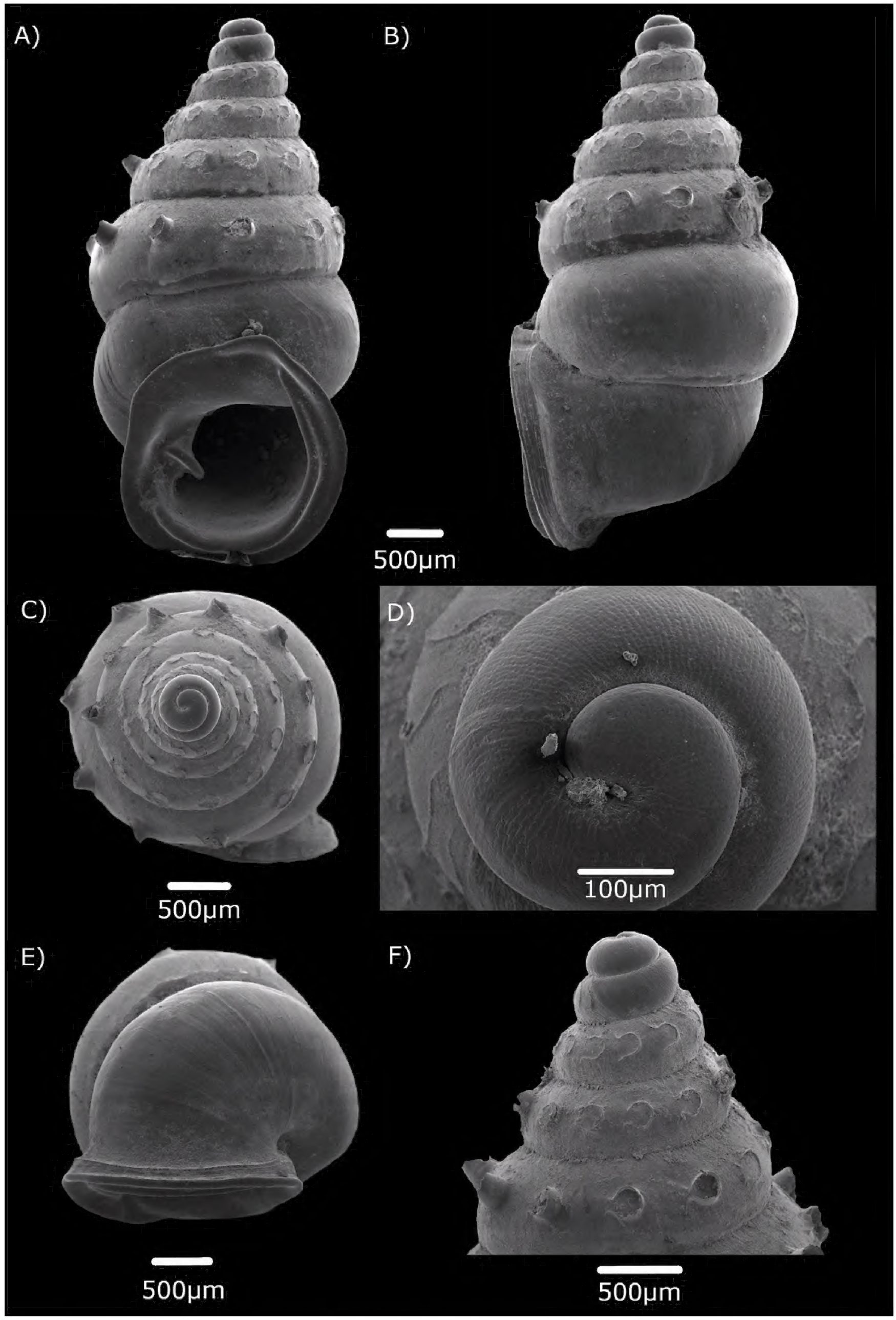

Figure 2. Scanning Electron Microscope images of *Diplommatina rumbangensis* sp. nov. **A–F** Paratypes (ME 14471). **A** apertural view **B** side view **C** apical view **D** enlargement of apical view showing the apex with radial ribs **E** umbilical view **F** top whorls view showing the tubular projection and semi-circular scars.

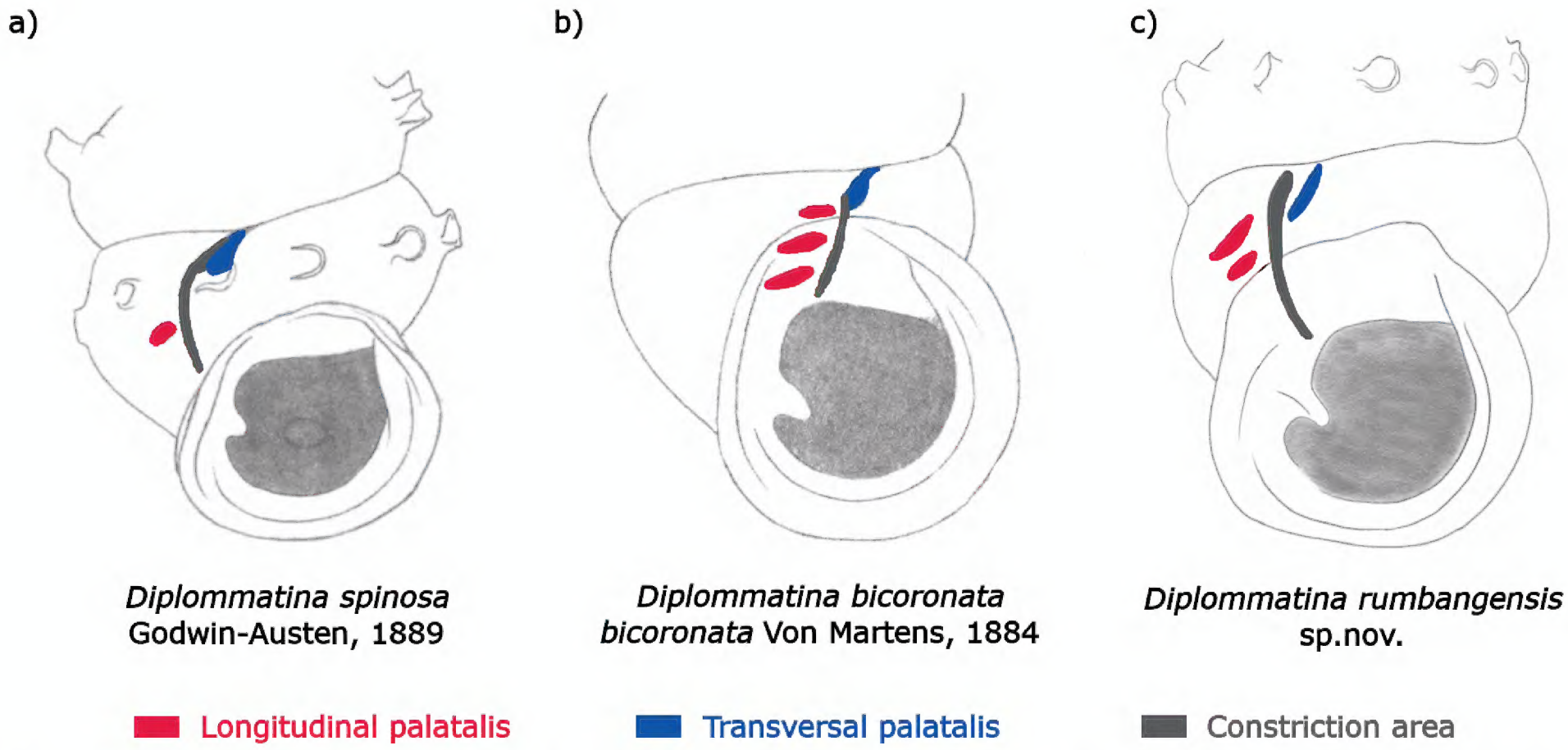

Figure 3. Sketch of *Diplommatina spinosa* and *Diplommatina bicoronata bicoronata* extracted from Vermeulen (1993), and *Diplommatina rumbangensis* sp. nov. showing the position of the longitudinal palatalis (red), the transversal palatalis (blue), and the constriction area (grey).

covered by the peristome. *Diplommatina bicoronata bicoronata* also has radial ribs near the suture of the whorls which is absent in *D. rumbangensis* sp. nov. This latter species can be distinguished from *Diplommatina aurisdiaboli* Vermeulen, 1993 by the absence of palatal lip expanding up the suture of the previous whorl.

Etymology. The epithet *rumbangensis* refers to the type locality Gua Rumbang.

Geographic distribution and habitat. *Diplommatina rumbangensis* sp. nov. is known from the type locality only. The living animals were not observed.

Remarks. The spine or tubular projection of the shells of *Diplommatina rumbangensis* sp. nov. are mostly broken, leaving semi-circular scars.

Checklist

Class Gastropoda Cuvier, 1795,
Subclass Caenogastropoda Cox, 1960
Family Alycaeidae W. T. Blanford, 1864

***Chamalycaeus specus* (Godwin-Austen, 1889)**
Fig. 4A

Type locality. "In limestone caves at Jambusan, Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14470, ME 14982, ME 15020, MZU.MOL.16.116.

Distribution. Widespread in Borneo. Endemic to Borneo (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Pincerna globosa* (H. Adams, 1871)**
Figs 4B, 19A

Type locality. "Busan, near Sarawak, Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14468, ME 15018, MZU.MOL.16.109, MZU.MOL.22.135, MZU.MOL.23.139.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Niah, further to the north. Also found in Sabah and West Kalimantan. Endemic to Borneo (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

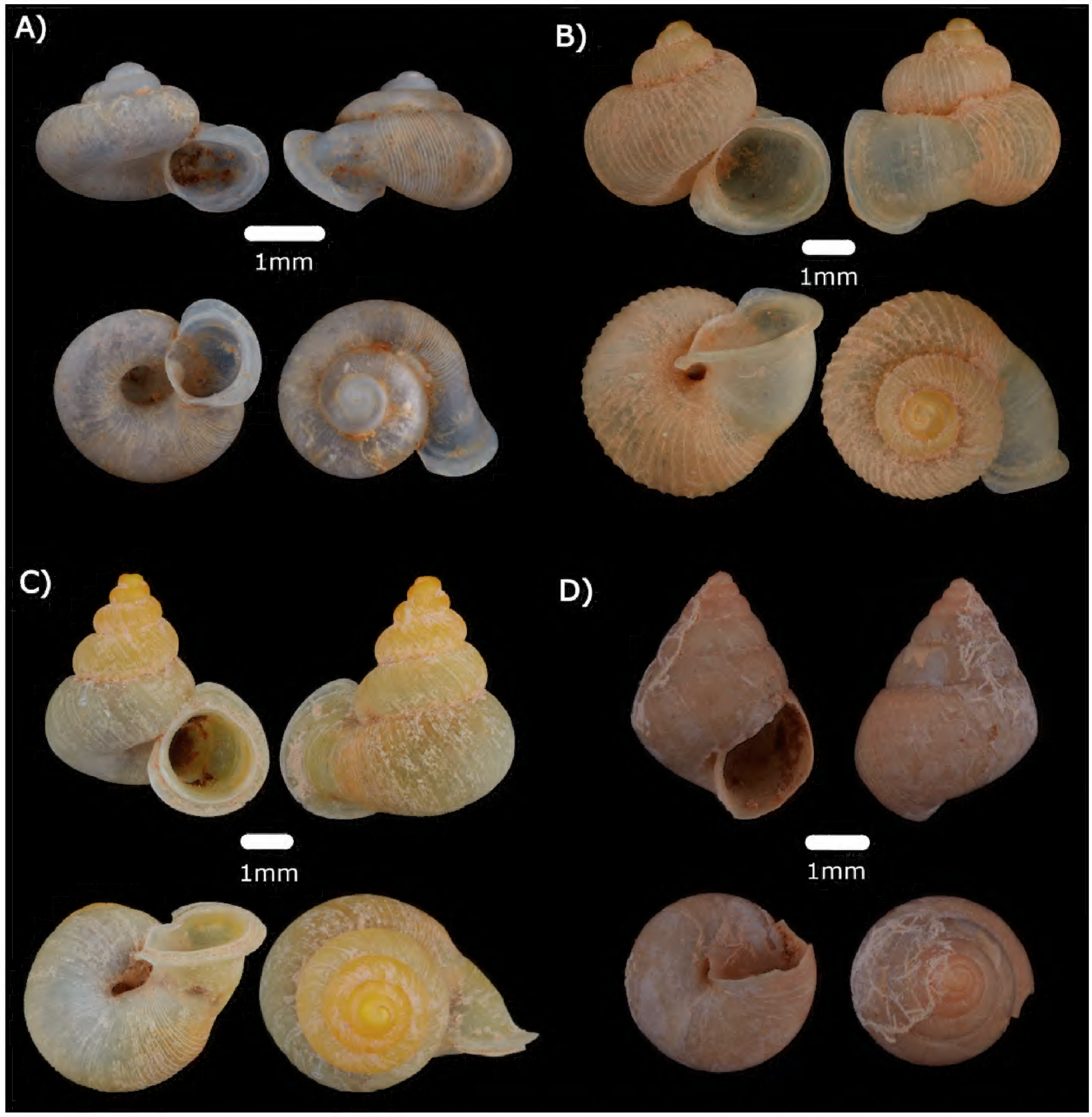

Figure 4. A *Chamalycaeus specus* (Godwin-Austen, 1889) ME 14470 **B** *Pincerna globosa* (H. Adams, 1871) ME 14468 **C** *Stomacosmethis hosei* (Godwin-Austen, 1889) ME 14469 **D** *Solenomphala scalaris* (Heude, 1882) ME 14512.

***Stomacosmethis hosei* (Godwin-Austen, 1889)**
Figs 4C, 19B

Type locality. "Busan Hills, Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14469, ME 14981, ME 15019, MZU.MOL.16.108, MZU.MOL.22.136

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Living snails found on wet limestone surfaces covered with mosses. Empty shells were found among leaf litter at the base of limestone hills.

Family Assimineidae H. Adams & A. Adams, 1856

***Solenomphala scalaris* (Heude, 1882)**
Fig. 4D

Type locality. "Ad parietes humidos in civitate Chang-hai sat copiosa" [= Shanghai, China].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14512.

Distribution. Widely distributed in Borneo. Also found in China and Peninsular Malaysia (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Only empty shells were found. An introduced species. Records show that it occurs in the damp areas around human settlements (Chan 1997).

Family Cyclophoridae Gray, 1847

***Craspedotropis borneensis* (Godwin-Austen, 1889)**
Figs 5A, 19C

Type locality. "Busan Hills, Borneo" [= Jambusan Hills, Sarawak].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14980, ME 15016. MZU.MOL.22.137, MZU.MOL.23.141.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak.

Remarks. Living snails were found foraging on limestone surfaces and among leaf-litter and topsoil at the base of limestone cliffs. Living individuals of this species are always covered by dirt, which makes it difficult to be spotted.

***Cyclophorus perdix borneensis* (Metcalfe, 1852)**
Fig. 5B

Type locality. "Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14461, ME 15010, MZU.MOL.22.184.

Distribution. Widely distributed in Borneo and Sarawak but rare in Sabah (Marzuki et al. 2021; Vermeulen and Liew 2022). Also found in West Malaysia (Stoliczka 1872; Morgan 1885).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Ditropopsis everetti* (E. A. Smith, 1895)**

Fig. 5C

Type locality. "Rumbang, Sarawak" [= Rumbang Hills, Padawan, Sarawak].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14467, ME 15017.

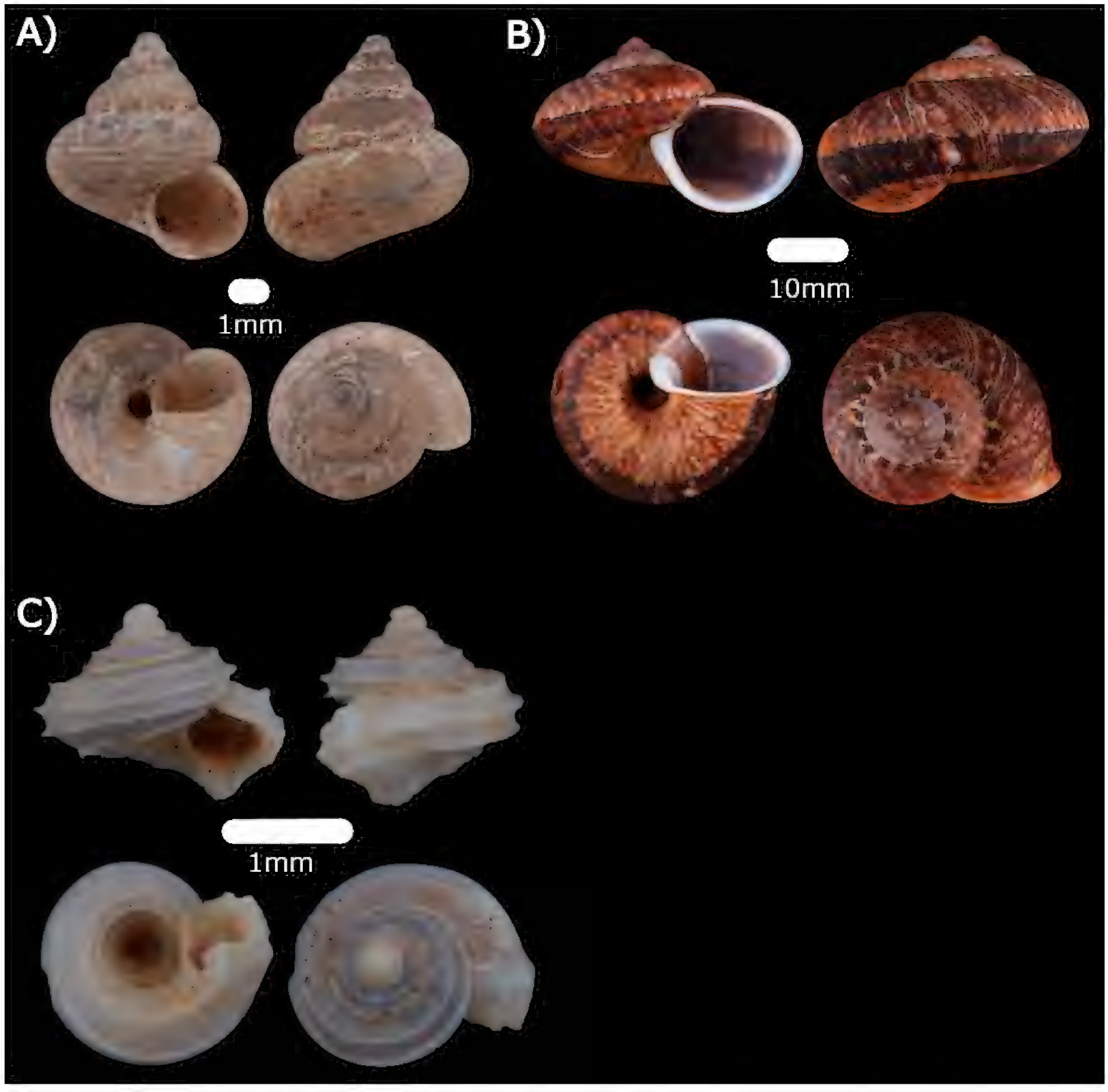

Figure 5. A *Craspedotropis borneensis* (Godwin-Austen, 1889) MZU.MOL.22.137 **B** *Cyclophorus perdix borneensis* (Metcalfe, 1852) MZU.MOL.22.184 **C** *Ditropopsis everetti* (E. A Smith, 1895) ME 14467.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Japonia barbata* (L. Pfeiffer, 1855)**
Fig. 6A

Type locality. "Borneo, Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14464, ME 15012, MZU.MOL.22.149.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Mukah, also in central Sarawak. Endemic to Sarawak (Marzuki et al. 2021).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Japonia bauensis* Marzuki, Liew & Mohd-Azlan, 2021**
Fig. 6B

Type locality. "Bau and Serian-Padawan limestone hill clusters."

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14465, ME 15013, MZU.MOL.22.156.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in Sarawak. Endemic to Sarawak (Marzuki et al. 2021).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Japonia borneensis* (E. A. Smith, 1893)**
Figs 6C, 19D

Type locality. "Westliches Borneo bei Bengkajang" [= Western Borneo near Bengkayang].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; MZU.MOL.23.138, MZU.MOL.22.155, MZU.MOL.16.110.

Distribution. Widely distributed in Borneo (Vermeulen and Liew 2022).

Remarks. Living snails were found foraging in leaf-litter and plant debris at the base of limestone cliffs.

***Japonia mundyana* (Godwin-Austen, 1889)**
Fig. 6D

Type locality. "Busan Hills, Borneo" [= Jambusan Hills, Bau, Sarawak].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15014, MZU.MOL.22.133.

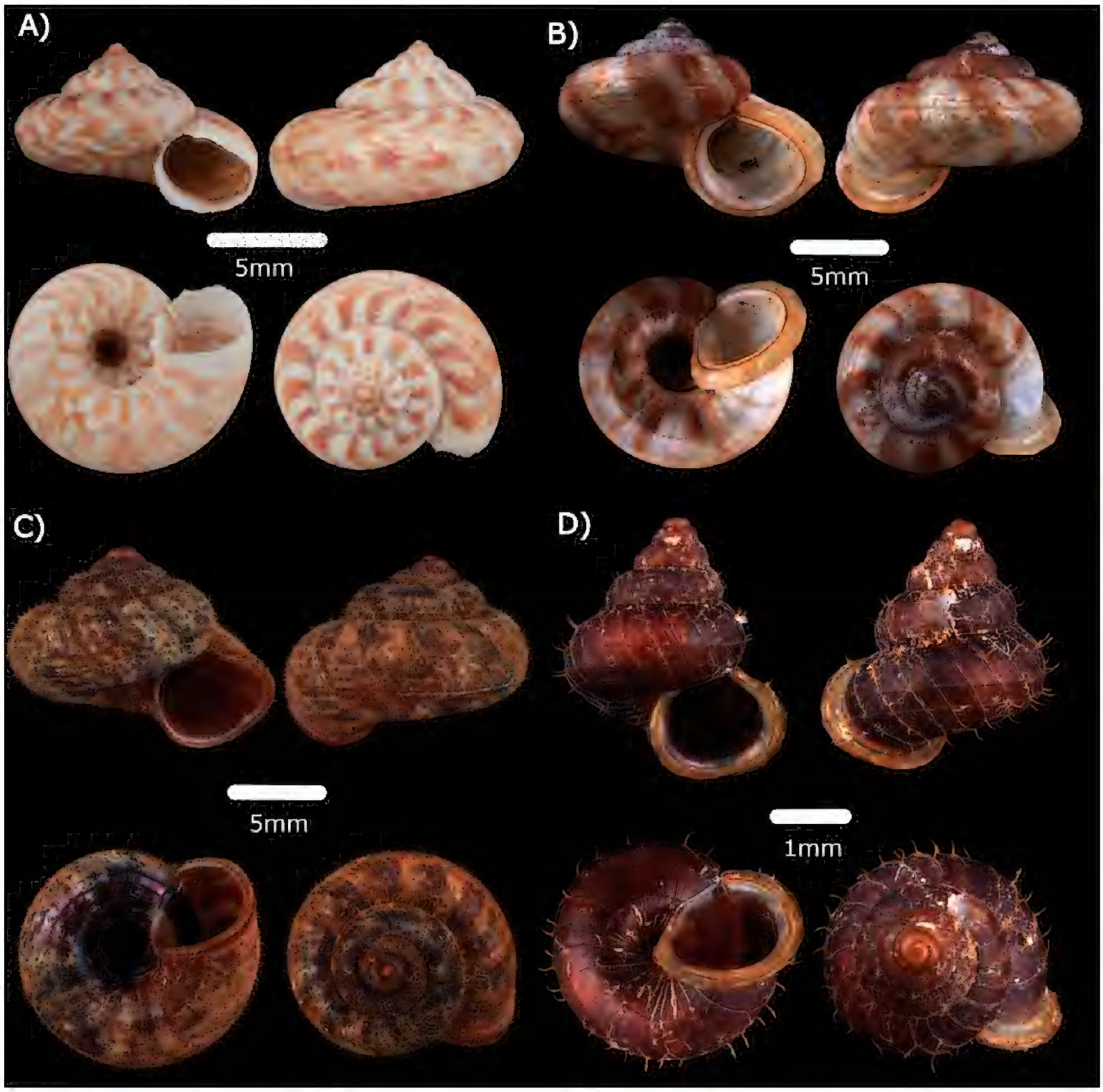

Figure 6. A *Japonia barbata* (L. Pfeiffer, 1855) MZU.MOL.22.149 **B** *Japonia bauensis* Marzuki, Liew & Mohd-Azlan, 2021 ME 0014465 **C** *Japonia borneensis* (E. A. Smith, 1893) MZU.MOL.22.155 **D** *Japonia mundyana* (Godwin-Austen, 1889) MZU.MOL.22.133.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Living snail was observed foraging on leaf surface of plants at the base of limestone cliffs.

***Leptopoma sericatum* (L. Pfeiffer, 1851)**

Fig. 7A

Type locality. "Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15015, MZU.MOL.23.135.

Distribution. Widely distributed in Borneo (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Opisthoporus biciliatus* (Mousson, 1849)**

Figs 7B, 20A

Type locality. "Java" [= Borneo (Metcalfe 1852].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14463, ME 14979, ME 15011, MZU.MOL.22.152.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Mukah, also in central Sarawak. Endemic to Sarawak (Marzuki et al. 2021).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

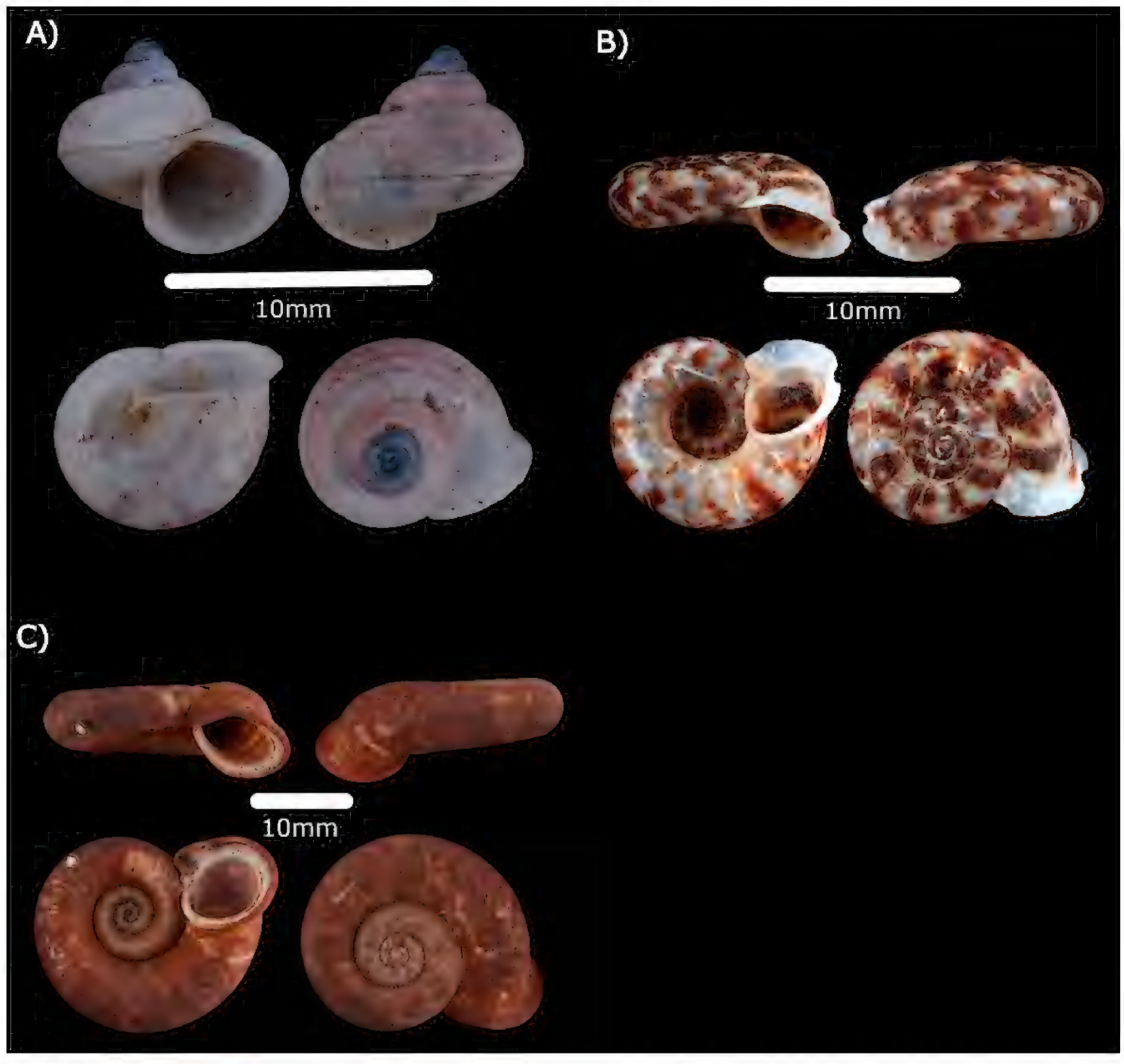

Figure 7. A *Leptopoma sericatum* (L. Pfeiffer, 1851) MZU. MOL.23.135 **B** *Opisthoporus biciliatus* (Mousson, 1849) ME 14463 **C** *Pterocyclos tenuilabiatus* (Metcalfe, 1852) MZU.MOL.22.129.

***Pterocyclos tenuilabiatus* (Metcalfe, 1852)**
Fig. 7C

Type locality. "Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14462, ME 14978, MZU.MOL.22.129.

Distribution. Widely distributed in Borneo. Endemic to Borneo (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

Family Diplommatinidae L. Pfeiffer, 1856

***Diplommatina adversa* (H. Adams & A. Adams, 1851)**
Figs 8A, 20B

Type locality. "Singapore".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14476, MZU.MOL.22.140, MZU.MOL.23.140.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. In Sabah found in Ulu Segama only (Marzuki et al. 2021; Vermeulen and Liew 2022). Also found in West Malaysia and Singapore (Laidlaw 1949).

Remarks. Living snails were found foraging in leaf-litter and plant debris at the base of limestone cliffs.

***Diplommatina baritensis* E. A Smith, 1893**
Figs 8B, 20C

Type locality. "Barit Mountain, N.W. Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14472, ME 14984, ME 15022, MZU.MOL.22.169, MZU.MOL.23.137.

Distribution. Scattered localities between Padawan limestone hills at western Sarawak and Mulu limestone hills in northern Sarawak (Smith 1895; Vermeulen 1993).

Remarks. Living snails were found foraging in leaf-litter and plant debris at the base of limestone cliffs.

***Diplommatina concinna* H. Adams, 1872**
Fig. 8C

Type locality. "Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14473, MZU.MOL.22.83.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Niah, in northern Sarawak. Also found in Bunguran, Indonesia (Marzuki et al. 2021) and Singapore (Chan 2020).

Remarks. Living snails were found foraging in leaf-litter and plant debris at the base of limestone cliffs.

***Diplommatina maduana maduana* Laidlaw, 1949**
Fig. 8D

Type locality. "Gua Madu, Kelantan".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14474, ME 15023, MZU.MOL.22.190.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Mulu hills in northern Sarawak (Marzuki et al. 2021). Also found in West Malaysia (Laidlaw 1949).

Remarks. Living snails were found foraging in leaf-litter and plant debris at the base of limestone cliffs.

***Diplommatina subglaber subisensis* (Vermeulen, 1993)**
Fig. 8F

Type locality. "Sarawak 4th Div.: G. Subis (Batu Niah)".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14475.

Distribution. Scattered localities between Padawan limestone hills in western Sarawak and Niah limestone hills in northern Sarawak (Vermeulen 1993, 1996).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Opisthostoma brachyacrum lambii* (Vermeulen, 1991)**
Fig. 9A

Type locality. "Sarawak 1st Div.: W of Kpg. Lobang Batu 12.5 km S of Tebakang".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14480, ME 15027, MZU.MOL.22.211.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Also found in Sabah. Endemic to Borneo (Marzuki et al. 2021).

Remarks. Living snails were found foraging in leaf-litter and plant debris at the base of limestone cliffs.

***Opisthostoma tridens* Vermeulen, 1991**
Fig. 9B

Type locality. "Sarawak 1st Div.: Kpg. Beratok along road Kuching-Serian".

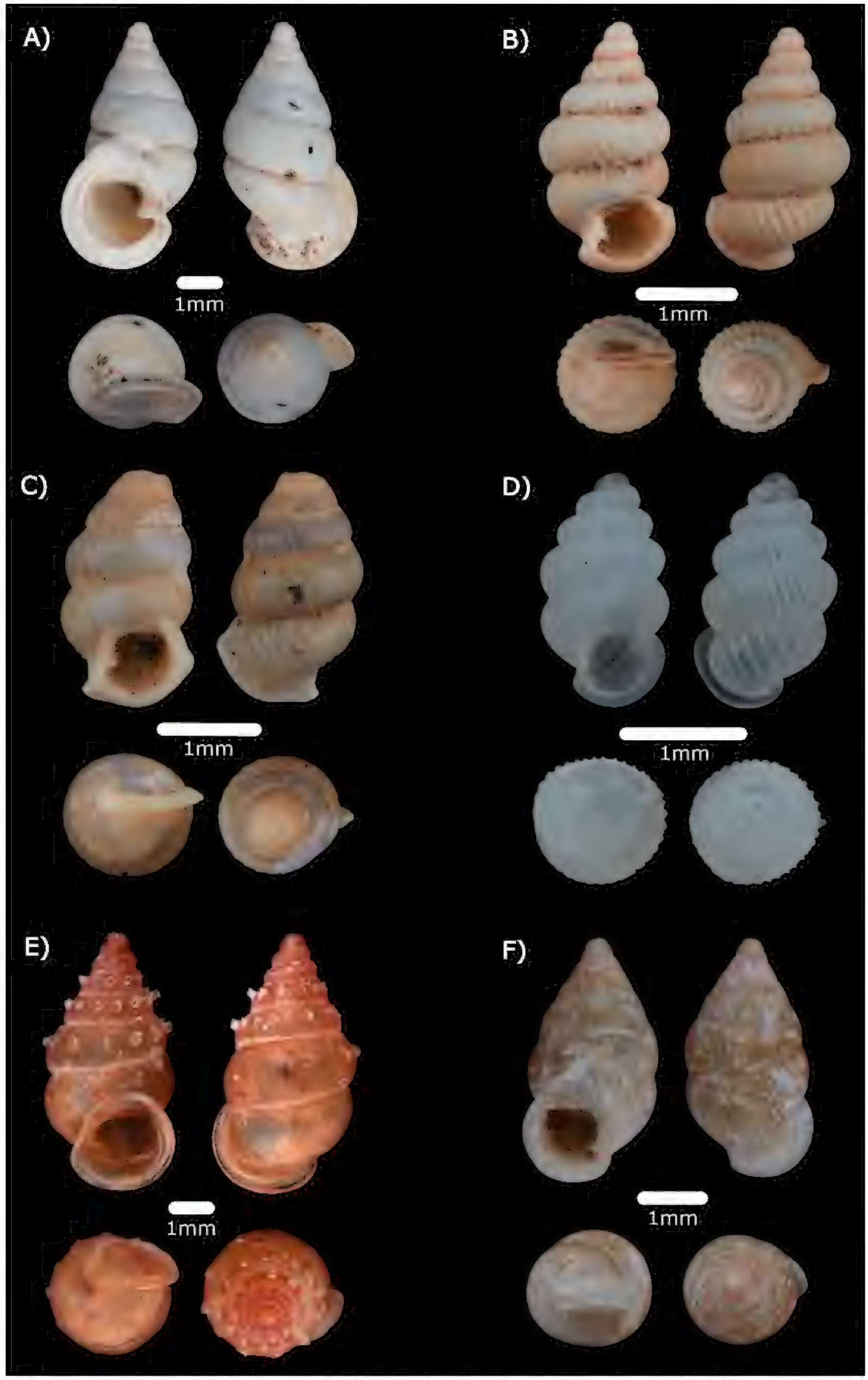

Figure 8. A *Diplommatina adversa* (H. Adams & A. Adams, 1851) ME 14476 **B** *Diplommatina baritensis* E. A. Smith, 1893 ME 14472 **C** *Diplommatina concinna* H. Adams, 1872 ME 14473 **D** *Diplommatina maduana maduana* Laidlaw, 1949 ME 14474 **E** *Diplommatina rumbangensis* sp. nov. holotype MZU.MOL.22.132 **F** *Diplommatina subglaber subisensis* (Vermeulen, 1993) ME 14475.

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14481, ME 15028, MZU.MOL.22.443.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak region (Marzuki et al. 2021).

Remarks. Living snails found on wet vertical limestone surfaces covered with mosses.

***Plectostoma anisopterum* (Vermeulen, 1994)**
Figs 9C, 20D

Type locality. "G. Saak 1 mile W. of Begu, 24 miles S. of Kuching".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14479, ME 14987, ME 15026, MZU.MOL.16.112, MZU.MOL.22.134, MZU.MOL.23.142.

Distribution. Scattered localities in Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Vermeulen 1994).

Remarks. Living snails found on wet vertical limestone surfaces covered with mosses. It can also be found among boulders.

***Plectostoma austeni* (E. A. Smith, 1894a)**
Figs 9D, 21B

Type locality. "Rumbang, Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14478, ME 14986, ME 15025, MZU.MOL.22.144, MZU.MOL.16.113.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak region (Marzuki et al. 2021).

Remarks. Living snails found on wet vertical limestone surfaces and was observed foraging inside the rock crevices and cave walls, avoiding direct exposure to light.

***Plectostoma pumilio* (E. A Smith, 1894a)**
Figs 9E, 21A

Type locality. "Rumbang, Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14477, ME 14985, ME 15024, MZU.MOL.16.114.

Distribution. Scattered localities in Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak region (Vermeulen 1994).

Remarks. Living snails found on wet vertical limestone surfaces covered with mosses.

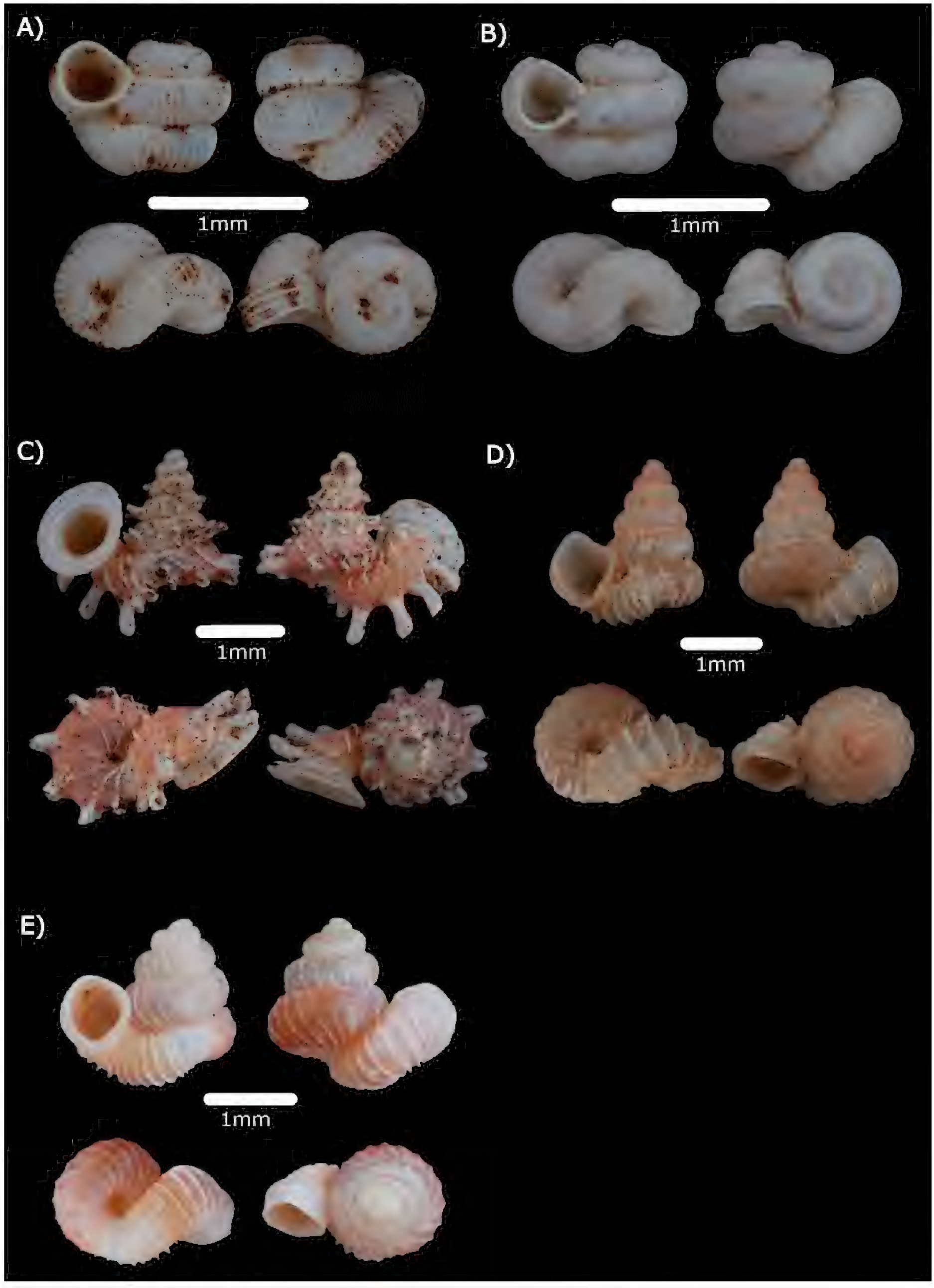

Figure 9. **A** *Opisthostoma brachyacrum lambii* Vermeulen, 1991 ME 14480 **B** *Opisthostoma tridens* Vermeulen, 1991 ME 14481 **C** *Plectostoma anisopterum* (Vermeulen, 1994) ME 14479 **D** *Plectostoma austeni* (E. A. Smith, 1894a) ME 14478 Gua Rumbang **E** *Plectostoma pumilio* (E. A. Smith, 1894a) ME 14477.

Subclass Heterobranchia Burmeister, 1837
Family Achatinidae Swainson, 1840

***Allopeas clavulinum* (Potiez & Michaud, 1838)**
Fig. 10A

Type locality. "L'ile Bourbon" [= La Réunion].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14485, ME 14990, ME 15035, MZU.MOL.22.159.

Distribution. Widely distributed in Borneo. Circumtropical (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Allopeas gracile* (T. Hutton, 1834)**
Fig. 10B

Type locality. "Mirzapoor, India".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14486, ME 14991, ME 15036, MZU.MOL.22.161.

Distribution. Widely distributed in Borneo. Circumtropical (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Opeas hannense* (Rang, 1831)**
Fig. 10C

Type locality. "Village of Hann, Cap Vert peninsula, Dakar, Senegal".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14484, ME 14989, ME 15034, MZU.MOL.22.158.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Also found in Sabah. Distributed from Central America to Africa and Pacific (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Paropeas achatinaceum* (L. Pfeiffer, 1846)**
Fig. 10D

Type locality. "Java".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14487, ME 14992, ME 15037, MZU.MOL.16.147, MZU.MOL.22.160.

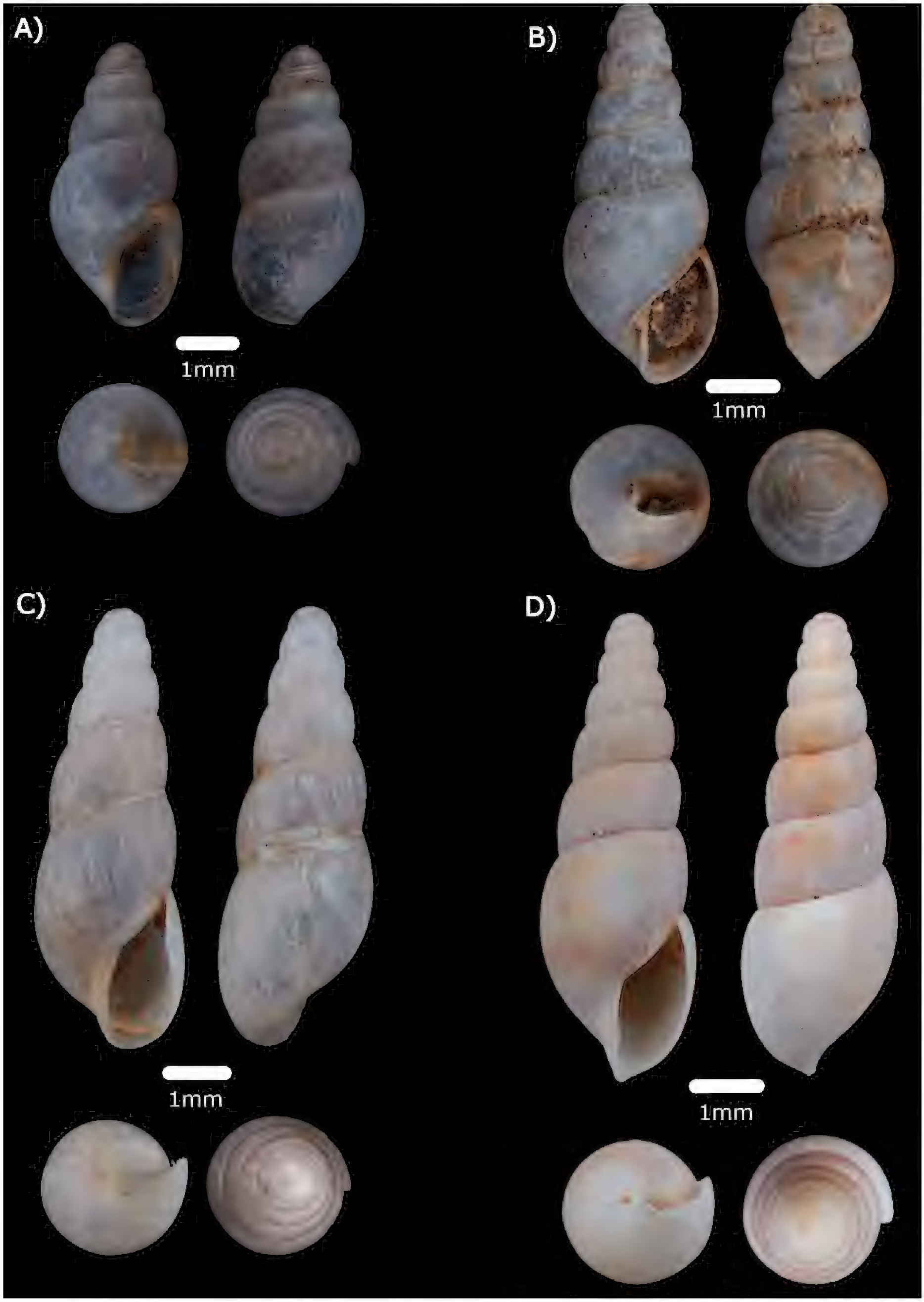

Figure 10. A *Allopeas clavulinum* (Potiez & Michaud, 1838) ME 14485 **B** *Allopeas gracile* (T. Hutton, 1834) ME 14486 **C** *Opeas hannense* (Rang, 1831) ME 14484 **D** *Paropeas achatinaceum* (L. Pfeiffer, 1846) ME 14487.

Distribution. Widely distributed in Borneo. Distributed from South to East Asia, South-east Asia, and Pacific Islands (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

Family Achatinellidae Gulick, 1873

***Elasmias sundanum* (Möllendorff, 1897)**
Fig. 11A

Type locality. "Java".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14514, ME 15058, MZU.MOL.23.149.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Niah at further northern Sarawak (Marzuki et al. 2021). Also found in Sumatra and Java (van Benthem-Jutting 1952).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

Family Ariophantidae Godwin-Austen, 1883

***Rahula raricostulata* (E. A. Smith, 1893)**
Figs 11B, 21C

Type locality. "Busau or Busan, Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14495, ME 15043, MZU.MOL.22.139.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

***Macrochlamys sanctijohni* (Godwin-Austen, 1891)**
Fig. 11C

Type locality. "Busan Hills".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14500, ME 14998, ME 15048, MZU.MOL.22.451.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Niah in northern Sarawak (Marzuki et al. 2021). Also found in Palawan, Philippines (Smith 1895).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Macrochlamys infans* (Reeve, 1854)**
Figs 11D, 21D

Type locality. "Borneo".

Material examined. Malaysia • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14501, ME 15061, MZU.MOL.16.118, MZU.MOL.22.449, MZU.MOL.23.144.

Distribution. Widely distributed in Borneo. Distributed from Sumatra to Philippines (Vermeulen and Liew 2022).

Remarks. Empty shells were found among leaf-litter and plant debris at the base of limestone cliffs while living snails were found foraging on leaf surfaces.

***Vitrinula glutinosa* (Metcalfe, 1852)**
Figs 11E, 22A

Type locality. "Borneo".

Material examined. Malaysia • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14502, ME 15049, MZU.MOL.22.130, MZU.MOL.23.146.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Mulu at northern Sarawak. Endemic to Borneo (Marzuki et al. 2021).

Remarks. Empty shells were found among leaf-litter and plant debris at the base of limestone cliffs while living snails were found foraging on leaf surfaces. Individuals of this species show variability in the height of the spire and in the colour (pale to dark brown) (Marzuki et al. 2021).

***Microcystina arabii* Marzuki, Liew & Mohd-Azlan, 2021**
Fig. 12A

Type locality. "Malaysia, Sarawak, Kuching, Division, Bukit Sokwang (Site 2), northern site of Gunung Doya, limestone hill along Skio road, 2.05 miles E Bau".

Material examined. Malaysia • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14505, MZU.MOL.23.152.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Microcystina kilat* Marzuki, Liew & Mohd-Azlan, 2021**
Fig. 12B

Type locality. "Malaysia, Sarawak, Kuching Division, Lobang Angin (Site 2), limestone outcrop near Sungai Sarawak Kanan, 1.75 miles W Bau".

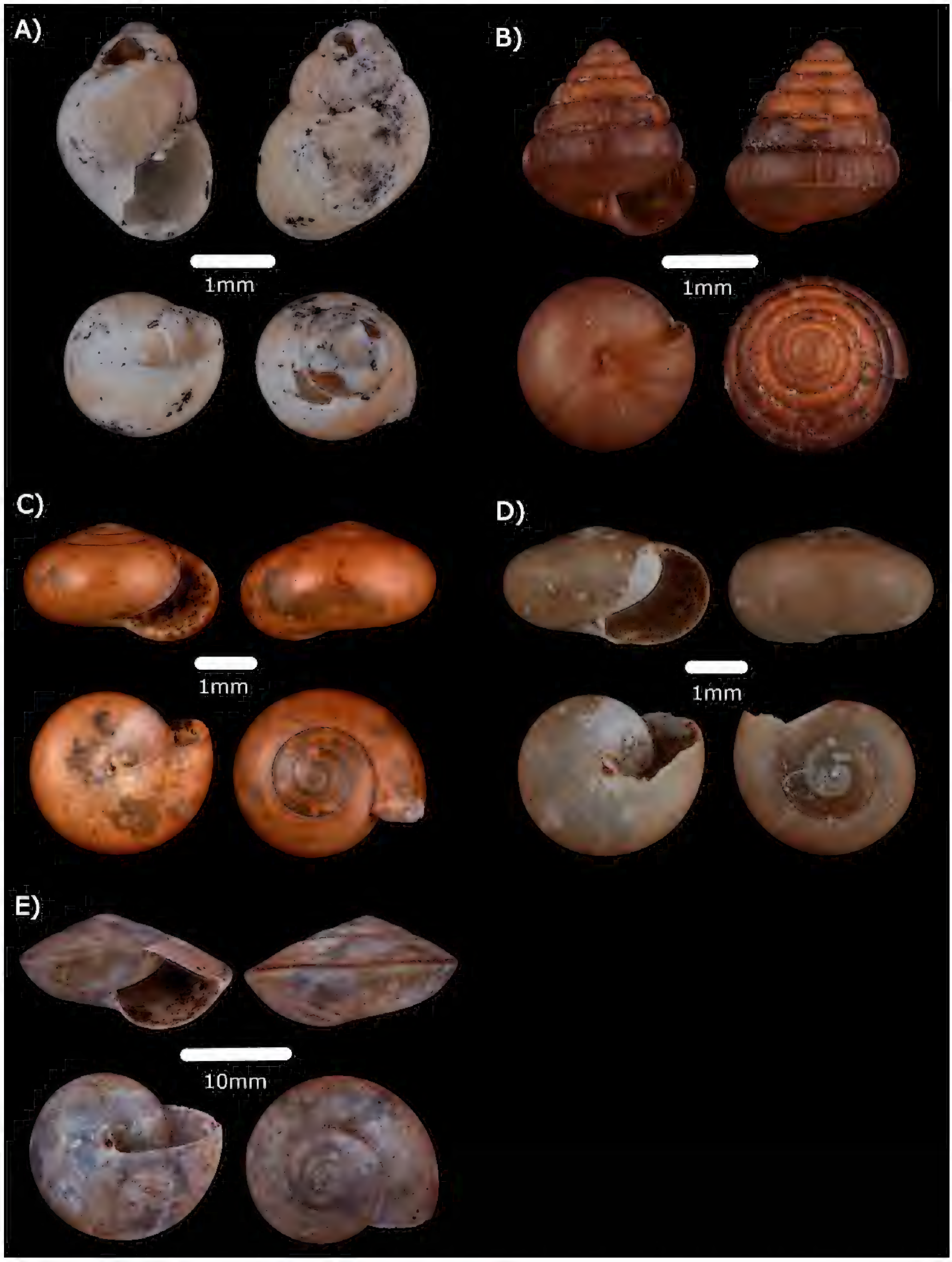

Figure 11. **A** *Elasmias sundanum* (Möllendorff, 1897) ME 15058 **B** *Rahula raricostulata* (E. A. Smith, 1893) MZU. MOL.22.139 **C** *Macrochlamys sanctijohni* (Godwin-Austen, 1891) ME 14500 **D** Semi adult *Macrochlamys infans* (Reeve, 1854) ME 14501 **E** *Vitrinula glutinosa* (Metcalfe, 1852) ME 14502.

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15050, MZU.MOL.23.151.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Microcystina paripari* Marzuki, Liew & Mohd-Azlan, 2021**
Fig. 12C

Type locality. "Malaysia, Sarawak, Kuching Division, Fairy Cave (Site 2), south part of Gunung Kapor, 4 miles SW Bau".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14503, ME 15000, ME 15052, MZU.MOL.22.132.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Microcystina physotrochus* Vermeulen, Liew & Schilthuizen, 2015**
Fig. 12D

Type locality. "Malaysia, Sabah, Sandakan Province, Kinabatangan Valley, Batu Keruak 2, near Sukau".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15060.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Niah in northern Sarawak. Also found in Sabah. Endemic to Borneo (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Microcystina vitreiformis* (Möllendorff, 1897)**
Fig. 12E

Type locality. "Java".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15051, MZU.MOL.16.117.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Niah in northern Sarawak. Also found in Java and its adjacent islands, Indonesia (Nurinsiyah, 2021).

Remarks. Only empty shells were found.

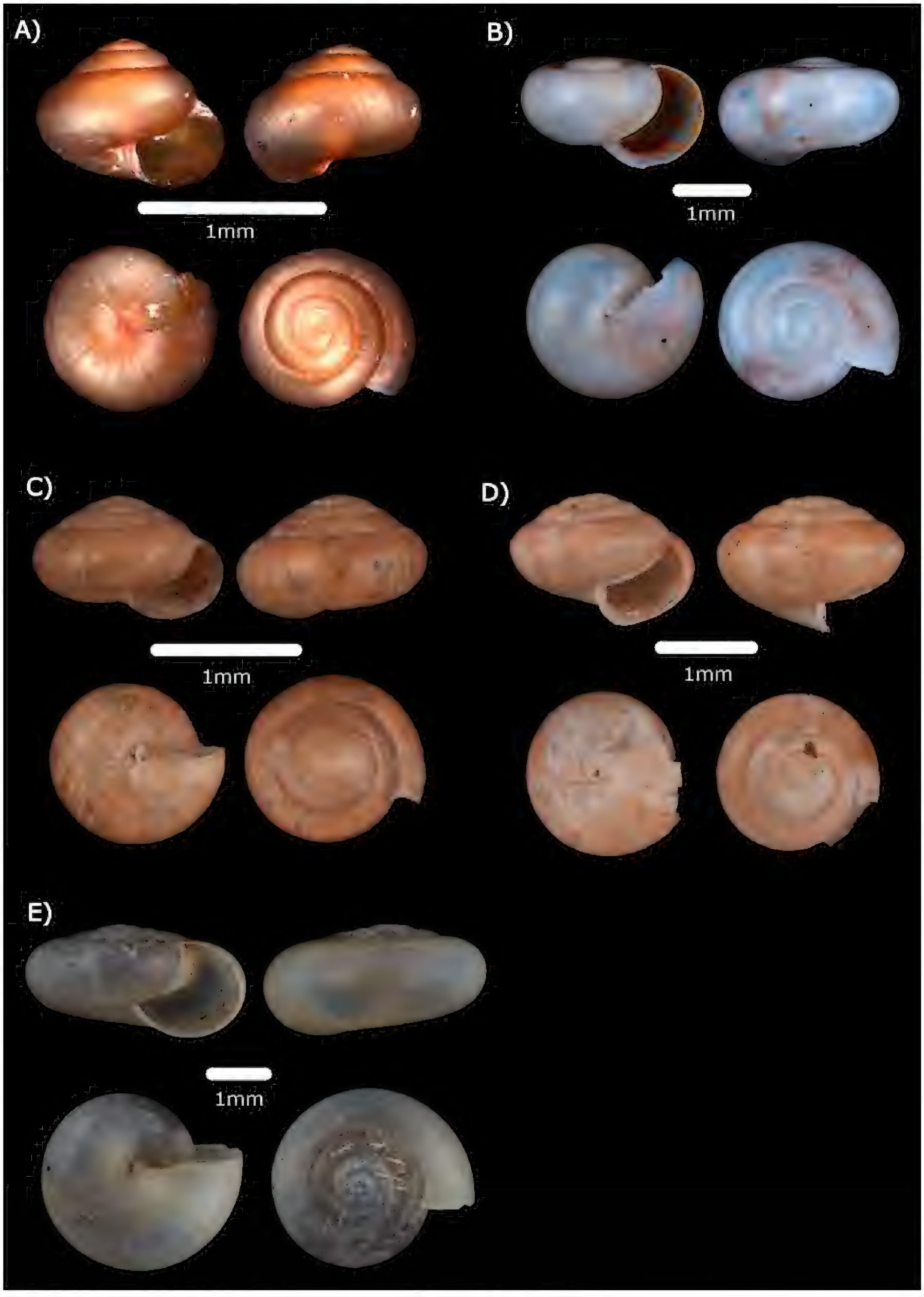

Figure 12. A *Microcystina arabii* Marzuki, Liew & Mohd-Azlan, 2021 ME 14505 **B** *Microcystina kilat* Marzuki, Liew & Mohd-Azlan, 2021 ME 15050 **C** *Microcystina paripari* Marzuki, Liew & Mohd-Azlan, 2021 ME 15052 **D** *Microcystina physotrochus* Vermeulen, Liew & Schilthuizen, 2015 ME 15060 **E** *Microcystina vitreiformis* (Möllendorff, 1897) MZU.MOL.16.117.

Family Camaenidae Pilsbry, 1895

***Amphidromus angulatus* Fulton, 1896**
Fig. 13A

Type locality. "Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; MZU.MOL.22.147.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak, to Niah, further northern Sarawak. Also found in West Kalimantan (Marzuki et al. 2021).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

***Amphidromus epidemiae* Wang, 2021**
Fig. 13B

Type locality. "Sarawak, Kuching Division, Bau".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; ME 14507, ME 15004, ME 15054, MZU.MOL.22.183.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak.

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Ganesella acris* (Benson, 1859)**
Fig. 13C

Type locality. "Teria Ghát montium Khasiæ" [= Khasi Hills, Teria Ghat, India].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14508, MZU.MOL.22.150, MZU.MOL.16.146.

Distribution. Widely distributed with scattered localities in Borneo. Distributed from Sumatra to Java Indonesia, and South to Southeast Asian mainland (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

Family Charopidae Hutton, 1884

***Philalanka kusana* (Aldrich, 1889)**
Fig. 13D

Type locality. "Kusan and Penggiron districts in South-eastern Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14509, MZU.MOL.16.111.

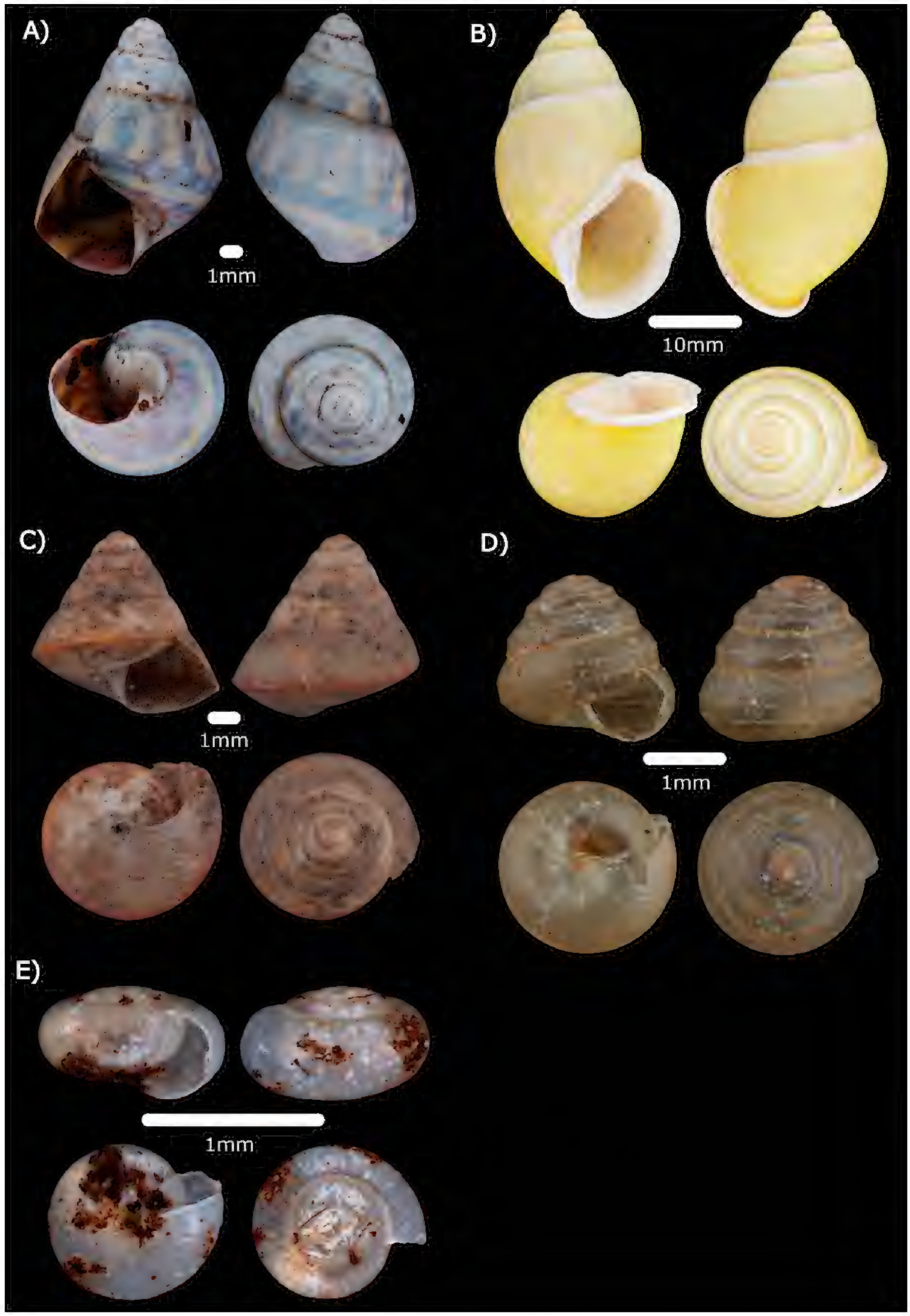

Figure 13. A *Amphidromus angulatus* Fulton, 1896 MZU.MOL.22.147 **B** *Amphidromus epidemiae* Wang, 2021 ME 14507 **C** *Ganesella acris* (Benson, 1859) MZU.MOL.22.150 **D** *Philalanka kusana* (Aldrich, 1889) MZU.MOL.16.111 **E** *Sundacharopa argos* Vermeulen & Liew, 2022 ME 14511.

Distribution. Widely distributed in Borneo. Distributed from West Malaysia to Papua (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

***Sundacharopa argos* Vermeulen & Liew, 2022**

Fig. 13E

Type locality. "Malaysia, Sabah, upper Padas River valley, Long Pa Sia".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14511.

Distribution. Widely distributed in Borneo. Endemic to Borneo (Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

Family Chronidae Thiele, 1931

***Kaliella barrakporensis* (Reeve, 1852)**

Figs 14A, 22B

Type locality. "Barrakpore Indiae (Bacon)" [= Barrackpore, West Bengal, India].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14489, ME 14994, ME 15039, MZU.MOL.22.148, MZU.MOL.23.143.

Distribution. Widely distributed in Borneo. Distributed from Africa and South Asia mainland to Indo-Australian archipelago and Europe (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

***Kaliella busauensis* (E. A. Smith, 1895)**

Figs 14B, 22C

Type locality. "Busau, Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Apr. 2016–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14488, ME 14993, ME 15038, MZU.MOL.16.115, MZU.MOL.22.144.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak.

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs. Vermeulen and Liew (2022) mentioned that this species is synonymous with *K. barrakporensis*. In contrast, Marzuki et al. (2021) listed it as separate species. *Kaliella busauensis* has a higher, dark brown shell with a cancellated shell surface caused by prominent spiral grooves and oblique radial riblets.

***Kaliella calculosa* (Gould, 1852)**
Fig. 14C

Type locality. "Tahiti" [= Tahiti Island, French Polynesia].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14493, ME 14506, MZU.MOL.22.450.

Distribution. Widely distributed in Borneo. Distributed from India to Australia and Pacific (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

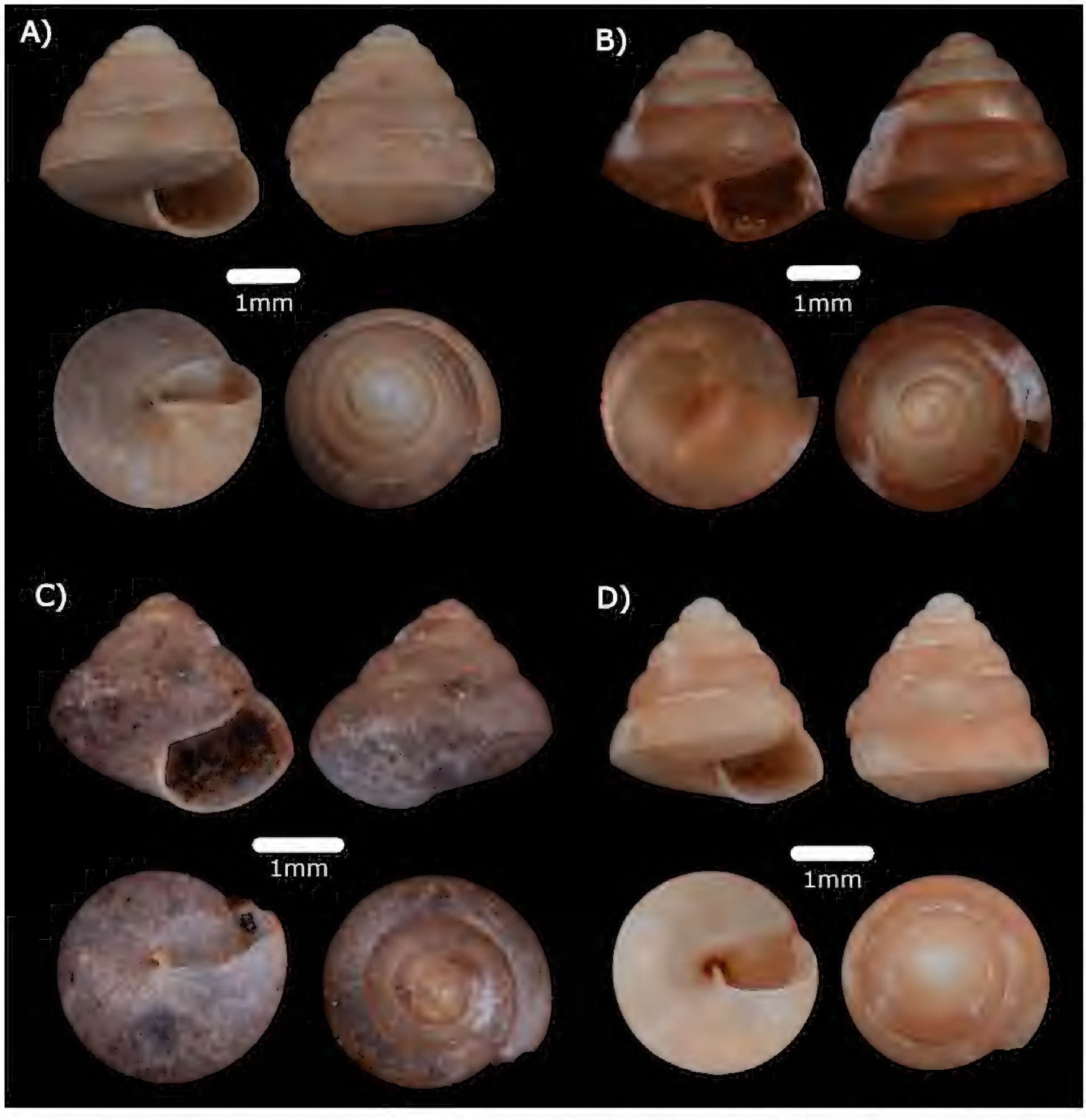

Figure 14. A *Kaliella barrakporensis* (Reeve, 1852) ME 14489 **B** *Kaliella busauensis* (E. A. Smith, 1895) ME 14488 **C** *Kaliella calculosa* (Gould, 1852) ME 14493 **D** *Kaliella microconus* (Mousson, 1865) ME 14490.

***Kaliella microconus* (Mousson, 1865)**
Fig. 14D

Type locality. "Lomma-Lomma (Viti)" [= Loma Loma, Fiji].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14490, ME 14995, ME 15040, MZU.MOL.22.168.

Distribution. Widely distributed in Borneo. Distributed from South-east Asia to Australia and the Pacific Islands (Marzuki et al. 2021; Vermeulen and Whitten 1998).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

***Kaliella rumbangensis* (E. A. Smith, 1895)**
Figs 15A, 22D

Type locality. "Rumbang, Sarawak and Mount Rabong".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14491, ME 14504, ME 14996, ME 15041, MZU.MOL.22.163, MZU.MOL.22.145.

Distribution. Padawan limestone hills in western Sarawak only. Endemic to western Sarawak (Smith, 1895).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs. Vermeulen and Liew (2022) listed this as synonymous with *K. barrakporensis*. *Kaliella rumbangensis* differs from *K. barrakporensis* by its smaller size and by the inconspicuous (or even absent) peripheral keel on the last whorl.

***Kaliella scandens* (Cox, 1872)**
Fig. 15B

Type locality. "Port Macquarie, east coast of Australia".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14492, ME 14997, ME 15042, MZU.MOL.22.444.

Distribution. Widely distributed in Borneo. Distributed from South-east Asia to Australia and the Pacific Islands (Marzuki et al. 2021; Vermeulen et al. 2015).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

***Exrhysota brookei* (A. Adams & Reeve, 1850)**
Figs 15C, 23

Type locality. "Mountains of Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; MZU.MOL.22.151.

Distribution. Widespread in Borneo. Endemic to Borneo (Marzuki et al. 2021).

Remarks. Living snails were found foraging in limestone crevices and in leaf litter. This is the largest native land snail species in Borneo.

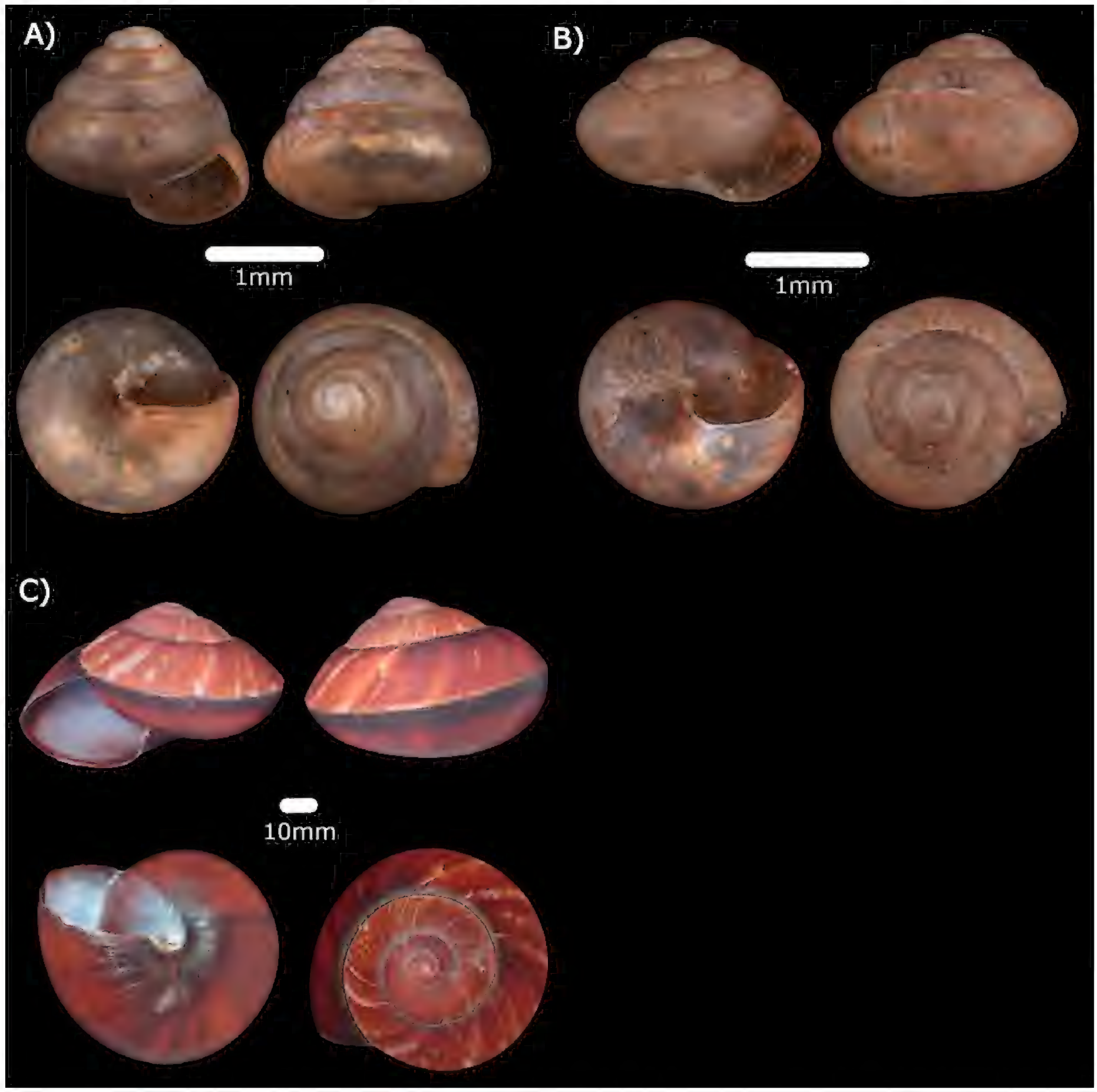

Figure 15. A *Kaliella rumbangensis* (E. A. Smith, 1895) ME 14491 **B** *Kaliella scandens* (Cox, 1872) ME 14492 **C** *Exrhysota brookei* (A. Adams & Reeve, 1850) MZU.MOL.22.151.

Family Diapheridae Panha & Naggs, 2010

***Platycochlium sarawakense* Laidlaw, 1950**
Figs 16A, 24A

Type locality. "Gunong Kapor, Bau District, Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14483, ME 14988, ME 15033, MZU.MOL.22.153.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Living snails found foraging among leaf-litter and plant debris at the base of limestone cliffs.

Family Dyakiidae Gude & B. B. Woodward, 1921

***Dyakia subdebilis* E. A. Smith, 1895**
Figs 16B, 24B

Type locality. "Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14496, ME 15044, MZU.MOL.22.141, MZU.MOL.23.136.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Marzuki et al. 2021).

Remarks. Living snails were found foraging on leaf surface of trees at the base of limestone cliffs and on limestone surfaces covered with mosses and lichens.

***Rhinocochlis nasuta* (Metcalfe, 1852)**
Fig. 16C

Type locality. "Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14497, ME 15002, ME 15045, MZU.MOL.22.146.

Distribution. Widely distributed in Borneo. Endemic to Borneo (Marzuki et al. 2021).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

Family Geotrochidae Schileyko, 2002

***Geotrochus conicoides* (Metcalfe, 1852)**
Fig. 16D

Type locality. "Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15057, MZU.MOL.23.150

Distribution. Widely distributed in Borneo. Widespread. Also found in Sumatra, Indonesia and Palawan, Philippines (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

Family Helicarionidae Bourguignat, 1877

***Helicarion dyakanum* (Godwin-Austen, 1891)**
Figs 17A, 24C

Type locality. "Busan Hills, Borneo" [= Jambusan Hills, Bau, Sarawak].

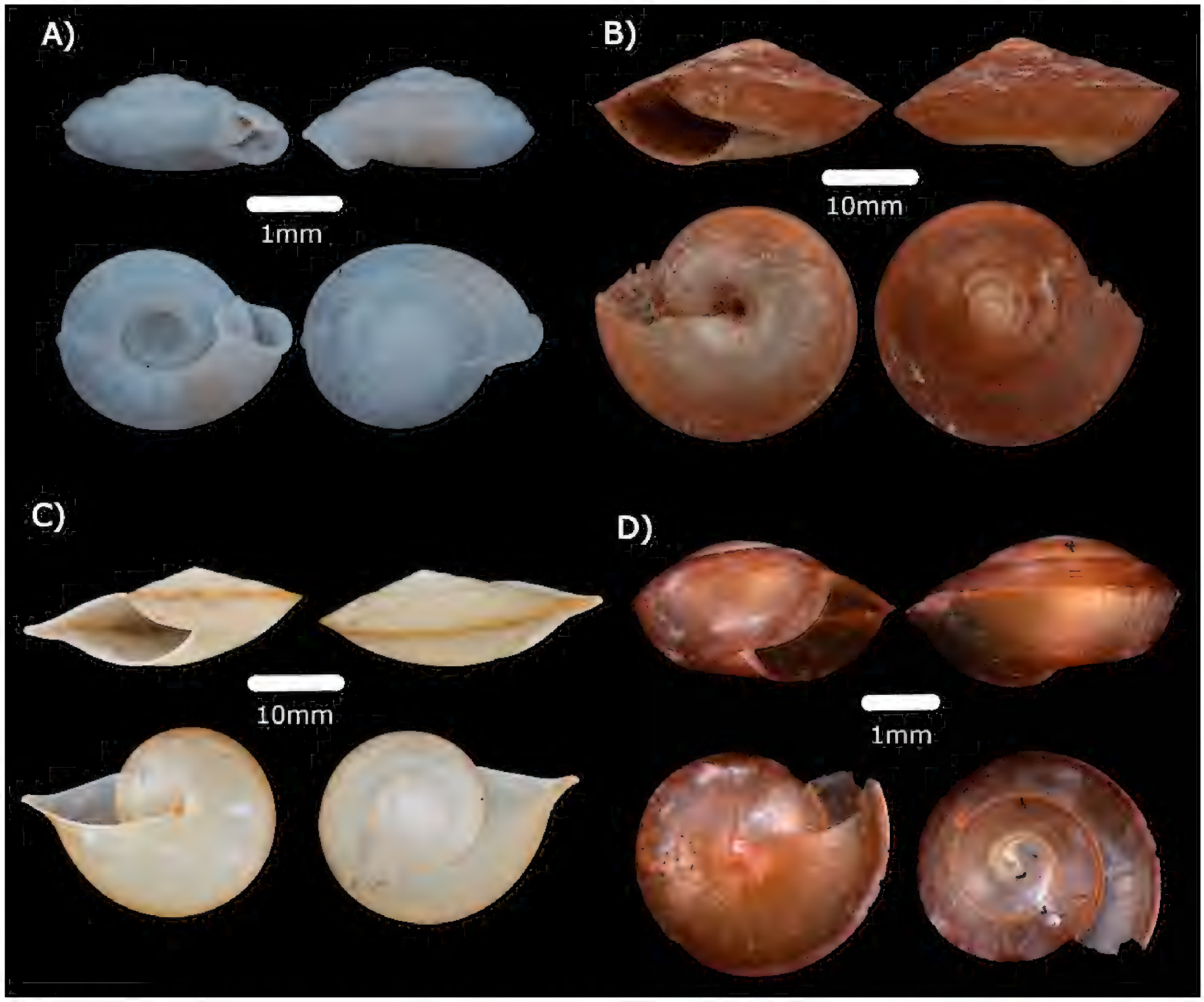

Figure 16. A *Platycochlium sarawakense* Laidlaw, 1950 ME 14483 **B** *Dyakia subdebilis* E. A. Smith, 1895 ME 14496 **C** *Rhinocochlis nasuta* (Metcalfe, 1852) ME 14493 **D** Juvenile *Geotrochus conicoides* (Metcalfe, 1852) ME 15057.

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14499, ME 15001.

Distribution. Widely distributed in Sarawak. In Sabah on Mount Trusmadi only. Endemic to Borneo (Marzuki et al. 2021; Vermeulen and Liew 2022).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

Family Punctidae Morse, 1864

***Paralaoma sarawakensis* Marzuki, Liew & Mohd-Azlan, 2021**
Figs 17B, 24D

Type locality. "Limestone hill along Skio road, 2.05 miles E Bau, Northern site of Gua Doya, Bukit Sokwang (Site 3), Kuching Division, Sarawak, Malaysia".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14510, ME 15055, MZU.MOL.22.448.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Also found in Baram, in northern Sarawak. Endemic to Sarawak (Marzuki et al. 2021).

Remarks. Living snails were found foraging among leaf-litter and plant debris at the base of limestone cliffs.

Family Pupinidae L. Pfeiffer, 1853

***Pupina evansi* Godwin-Austen, 1889**
Fig. 17C

Type locality. "From deposit in Cave A, Borneo" [= Tupak Cave, Jambusan Hills, see Cranbrook 2013)].

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15029.

Distribution. Scattered localities in Serian-Padawan limestone hills in western Sarawak (Marzuki et al. 2021). Also found in Sirhassen, Natuna Island (Smith 1894b).

Remarks. Among leaf-litter and plant debris at the base of limestone cliffs. Only empty shells were found.

Family Trochomorphidae Möllendorff, 1890

***Videna nepiadelphos* Vermeulen & Liew, 2022**
Fig. 17D

Type locality. "Danum valley Conservation Area, Tawau Prov., Sabah".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14513, ME 15056, MZU.MOL.22.447.

Distribution. Widely distributed in Borneo. Widespread. Also found in Panaitan island, Indonesia (Vermeulen and Liew 2022)

Remarks. Only empty shells were found among leaf-litter and plant debris at the base of limestone cliffs.

Family Valloniidae Morse, 1864

***Pupisoma dioscoricola* (C. B. Adams, 1845)**
Fig. 17E

Type locality. "Jamaica".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022–28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14498, ME 15003, ME 15046, MZU.MOL.22.445.

Distribution. Widely distributed in Borneo. Widespread. Distributed in Africa, Asia, Australia, and America (Marzuki et al. 2021).

Remarks. Living snails were observed foraging on leaf surface of trees at the base of limestone cliffs.

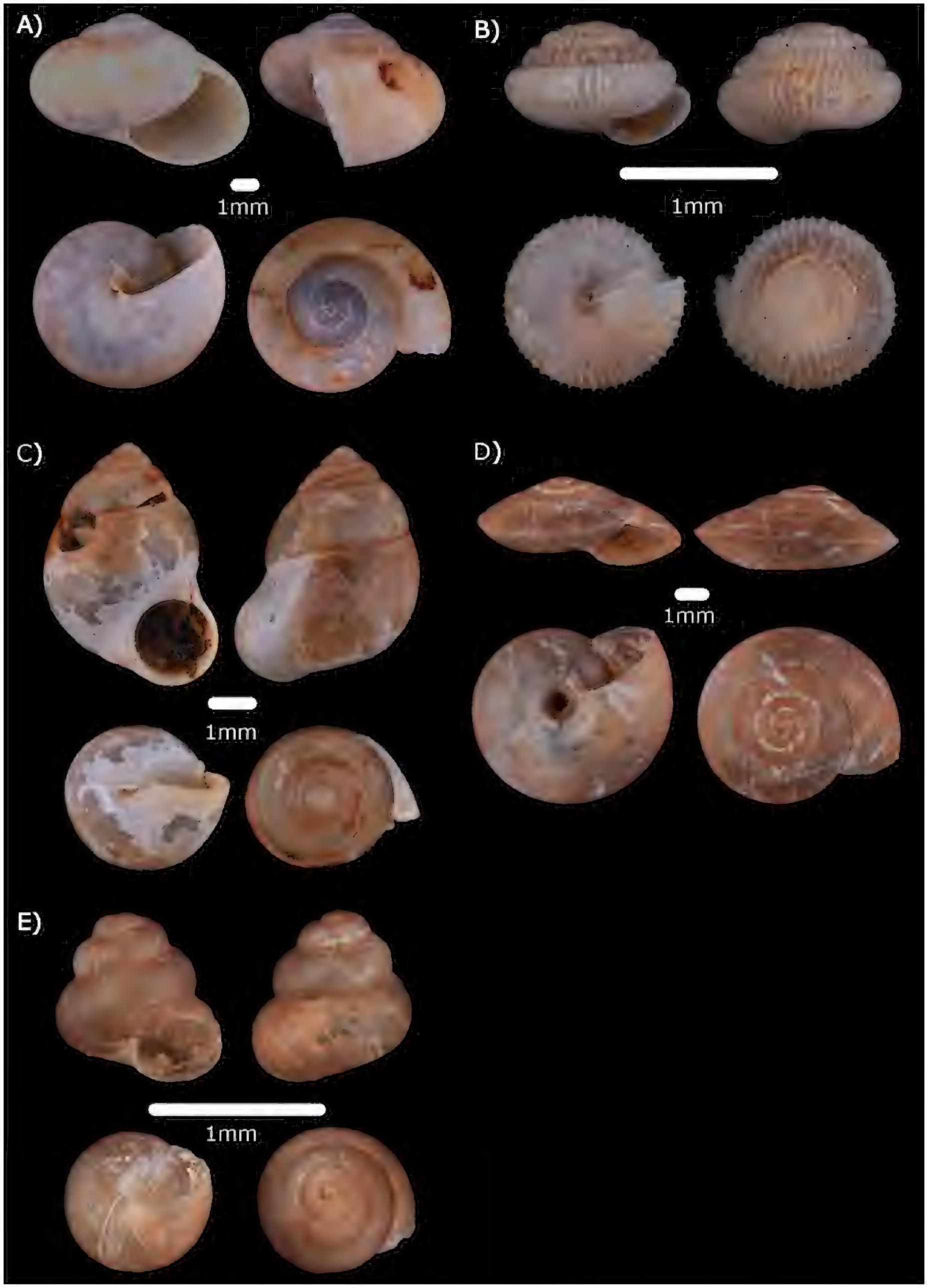

Figure 17. A *Helicarion dyakanum* (Godwin-Austen, 1891) ME 14499 **B** *Paralaoma sarawakensis* Marzuki, Liew & Mohd-Azlan, 2021 ME 14510 **C** *Pupina evansi* Godwin-Austen, 1889 ME 15029 **D** *Videna nepiadelphos* Vermeulen & Liew, 2022 ME 14513 **E** *Pupisoma dioscoricola* (C. B. Adams, 1845) ME 14498.

Subclass Neritimorpha Golikov & Starobogatov, 1975
Family Hydrocenidae Troschel, 1857

***Georissa everetti* E. A. Smith, 1895**
Fig. 18A

Type locality. "Rumbang, W. Sarawak".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 2 Sep. 2022; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 14482, MZU.MOL.22.157.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak to Niah in northern Sarawak. Also found in Sabah, Sepulut valley. Widespread. Endemic to Borneo (Khalik et al. 2019; Marzuki et al. 2021).

Remarks. Living snails were observed foraging on wet limestone wall surfaces covered with mosses.

***Georissa hungerfordi* Godwin-Austen, 1889**
Fig. 18B

Type locality. "Borneo".

Material examined. MALAYSIA • Sarawak, Padawan, Gua Rumbang; 1°16.77'N, 110°15.69'E; 28 Jun. 2023; N.S. Nasir, M.E Marzuki, J.Y. Lee, and M.Z Khalik leg.; ME 15032.

Distribution. Scattered localities between Bau and Serian-Padawan limestone hills in western Sarawak. Endemic to western Sarawak (Khalik et al. 2019; Marzuki et al. 2021).

Remarks. Living snails were observed foraging on wet limestone wall surfaces covered with mosses.

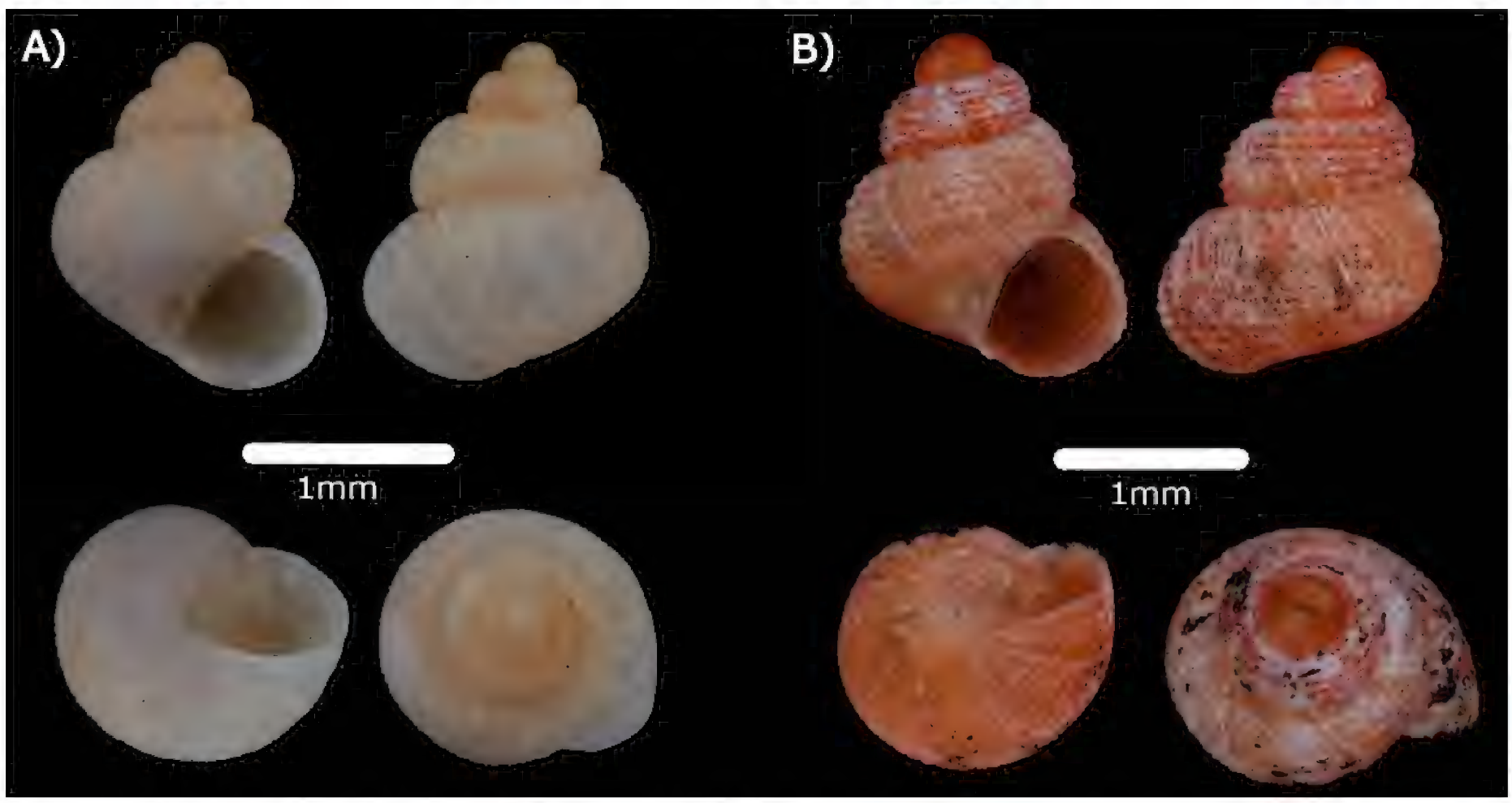

Figure 18. A *Georissa everetti* E. A. Smith, 1895 ME 14482 **B** *Georissa hungerfordi* Godwin-Austen, 1889 ME 15032.

Figure 19. Living snails from Gua Rumbang. **A** *Pincerna globosa* (H. Adams, 1871) MZU.MOL.22.135 **B** *Stomacosmethis hosei* (Godwin-Austen, 1889) MZU.MOL.22.136 **C** *Craspedotropis borneensis* (Godwin-Austen, 1889) MZU.MOL.23.141 **D** *Japonia borneensis* (E. A. Smith, 1893) MZU. MOL.23.138. Images not to scale.

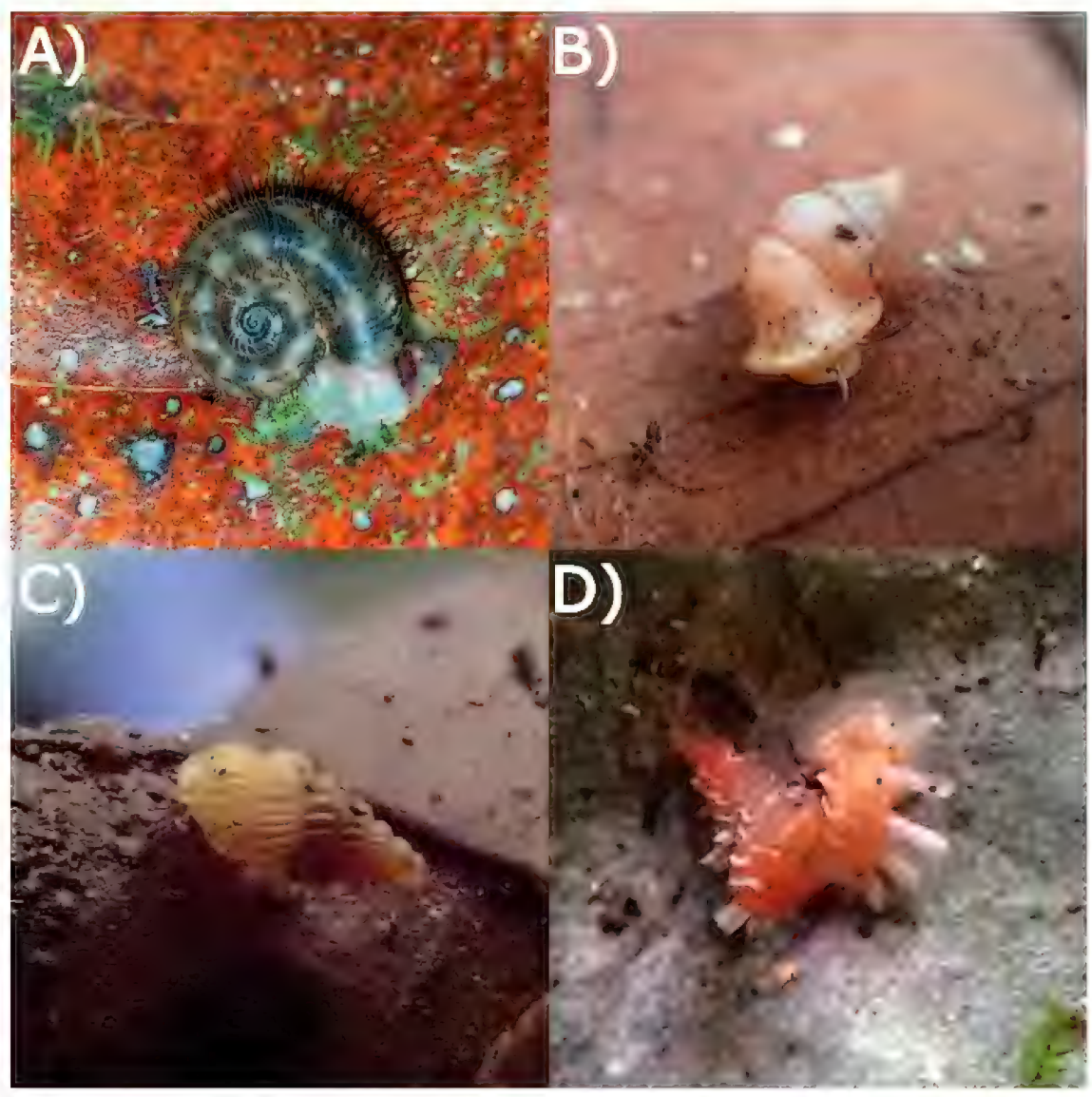

Figure 20. Living snails from Gua Rumbang. **A** *Opisthoporus biciliatus* (Mousson, 1849) ME 14979 **B** *Diplommatina adversa* (H. Adams & A. Adams, 1851) MZU. MOL.23.140 **C** *Diplommatina baritensis* E. A. Smith, 1893 MZU. MOL.23.137 **D** *Plectostoma anisopterum* ME 14479 (Vermeulen, 1994). All images not to scale.

Figure 21. Living snails from Gua Rumbang. **A** *Plectostoma pumilio* (E. A. Smith, 1894a) ME 14477 **B** *Plectostoma austeni* (E. A. Smith, 1894a) ME 14477 **C** *Rahula raricostulata* (E. A. Smith, 1893) MZU.MOL.22.139 **D** Semi adult *Macrochlamys infans* (Reeve, 1854) MZU.MOL.23.144. Images not to scale.

Figure 22. Living snails from Gua Rumbang. **A** Juvenile *Vitrinula glutinosa* (Metcalfe, 1852) MZU.MOL.23.146 **B** *Kaliella barrakporensis* (Reeve, 1852) MZU.MOL.23.143 **C** *Kaliella busauensis* (E. A. Smith, 1895) MZU.MOL.22.144 **D** *Kaliella rumbangensis* (E. A. Smith, 1895) MZU.MOL.22.163. Images not to scale.

Figure 23. Living snail from Gua Rumbang. *Exrhysota brookei* (A. Adams & Reeve, 1850) MZU.MOL.22.151.

Figure 24. Living snails from Gua Rumbang. **A** *Platycochlium sarawakense* Laidlaw, 1950 MZU.MOL.22.153 **B** *Dyakia subdebilis* E. A. Smith, 1895 MZU.MOL.23.136 **C** *Helicarion dyakanum* (Godwin-Austen, 1891) ME 14499 **D** *Paralaoma sarawakensis* Marzuki, Liew & Mohd-Azlan, 2021 ME 14510. All imaged not to scale.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

Conceptualization, M.Z.K., J.J.V., N.S.N., L.J.Y., and J.M.A; Fieldwork, N.S.N., L.J.Y., M.E.M., and M.Z.K.; Laboratory work, N.S.N., L.J.Y., M.E.M., and M.Z.K.; Analysis, N.S.N.; Data curation, all authors.; Writing the manuscript N.S.N., L.J.Y., M.E.M., J.J.V., J.M.A, and M.Z.K.; Supervision, M.Z.K.; Funding acquisition, M.Z.K.

Author ORCIDs

Jie Ying Lee https://orcid.org/0009-0002-6223-3814
Mohd Zacaery Khalik https://orcid.org/0000-0001-7098-0743

Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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Supplementary material 1

List of land snails and their microhabitat preferences of Gua Rumbang

Author: Nurul Syafiqah Nasir

Data type: xlsx

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